JULY 1955 — SIXTY-FIRST YEAR

# MACHINERY

# MACHINERY

VOLUME 61 JULY, 1955 NUMBER 11

**The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products**

### SHOP PRACTICE



### MACHINE AND TOOL DESIGN



### MANAGEMENT PROBLEMS AND EVENTS



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British Address
MACHINERY
National House, West St.
Brighton 1, England

French Address
LA MACHINE MODERNE
15, Rue Bleue
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BPA NBP

For more information on products advertised, use Inquiry Card, page 235

**1.** *Fewer "Rejects"*

Fellows Gear Inspection provides positive quality control during production runs . . . puts the finger on gear errors before costly waste occurs.

**2.** *Longer Cutter Life*

Competent Gear Inspection routines and instruments help to determine period of efficient cutter or finishing tool performance between sharpenings . . . prevent over-use and keep stock removal per sharpening at a minimum.

**3.** *Less Production Time Lost*

Fellows Gear Inspection identifies the nature of gear errors and permits fast correction . . . before expensive hours of machine time and labor are wasted.

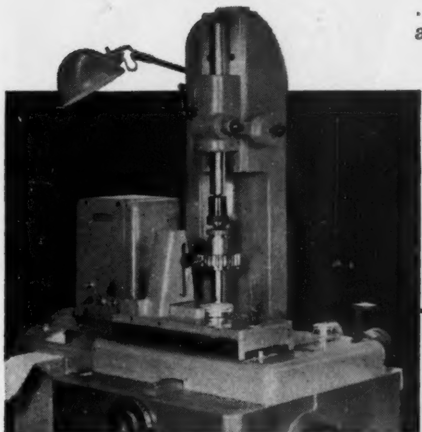
**4.** *"Fool-Proof" Assembly*

Fellows Gear Inspection gives proof-positive that specified gear limits have been met before costly man-hours have been invested in assembly.

**5.** *Improved Customers' Good Will*

If you are making gears for your own use . . . Fellows Inspection Instruments assure superior gear performance throughout the service life of your product. If you are making gears for another manufacturer . . . Fellows Instruments give you CHART RECORDED PROOF beyond argument of the delivery of specified precision.

There's a Fellows Gear Inspection Instrument to help every type of operation to increase profits. Why not discuss this important matter with your Fellows Representative soon? If interested, ask him for data about The Fellows Plan for deferred payments. Write, wire or phone any Fellows Sales Office.



**Fellows**
**INVOLUTE MEASURING INSTRUMENTS**

Feature electronic recorders. Permanent chart records at 500 to 1 magnification. Measures the location and amount of any planned-for involute modifications. 12 and 24 inch capacity models.

**GEAR SHAPER COMPANY**

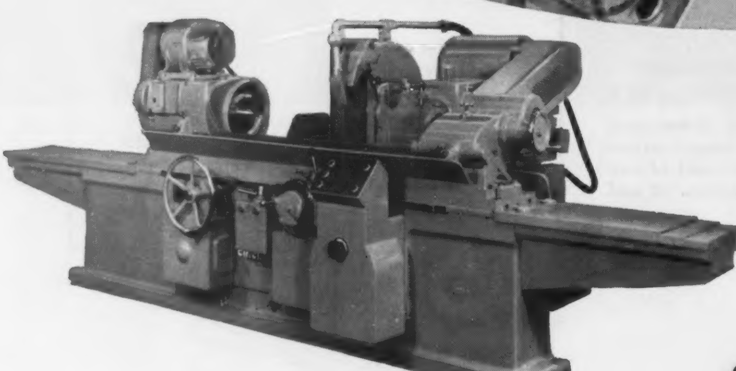
*Head Office and Export Department:* 78 River Street, Springfield, Vermont.
*Branch Offices:* 319 Fisher Building, Detroit 2 • 5835 West North Avenue, Chicago 39
2206 Empire State Building, New York 1 • 6214 West Manchester Avenue, Los Angeles 45

# Cincinnati Filmatic 18″

## Adds the final touch of quality to

HardClad* radial drill columns are ground to a high degree of accuracy and finish on this CINCINNATI FILMATIC 18″ x 72″ Plain Grinding Machine.

FILMATIC

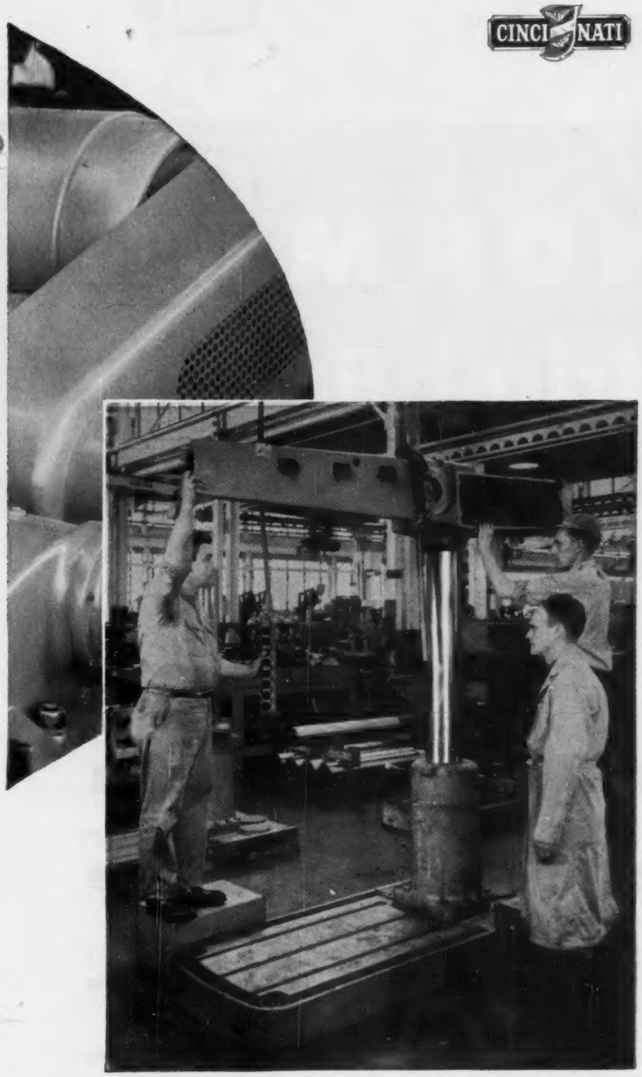


CINCINNATI FILMATIC 18″ Plain Grinding Machine.

# CINCIN

# Plain Grinder

## *HardClad** columns



Assembling a radial drilling machine, in the plant of the Cincinnati Lathe and Tool Co.

CINCINNATI

Accuracy begets accuracy. It's especially true for radial drill columns, where high-quality finish and accurate, straight sizing are basic considerations to high-quality performance. HardClad* radial drill columns, a new non-scoring development by Cincinnati Lathe and Tool Co., are ground at low cost and to the highest standards of quality on the CINCINNATI FILMATIC 18" Plain Grinder illustrated here. These machines have many advantages for quickly grinding large work to the highest quality desired:

FILMATIC grinding wheel spindle bearings ... outlast the machine; never require adjustment

Automatic wheel balancing ... in seconds; while the machine is running

Automatic lubrication

Electronically controlled table traverse speeds

Many additional features of high-quality, low-cost performance. Write for more information.

**CINCINNATI GRINDERS INCORPORATED**
**CINCINNATI 9, OHIO**

MACHINE TOOL SHOW
INTERNATIONAL AMPHITHEATRE
CHICAGO, ILL.
SEPT. 6-17, 1955

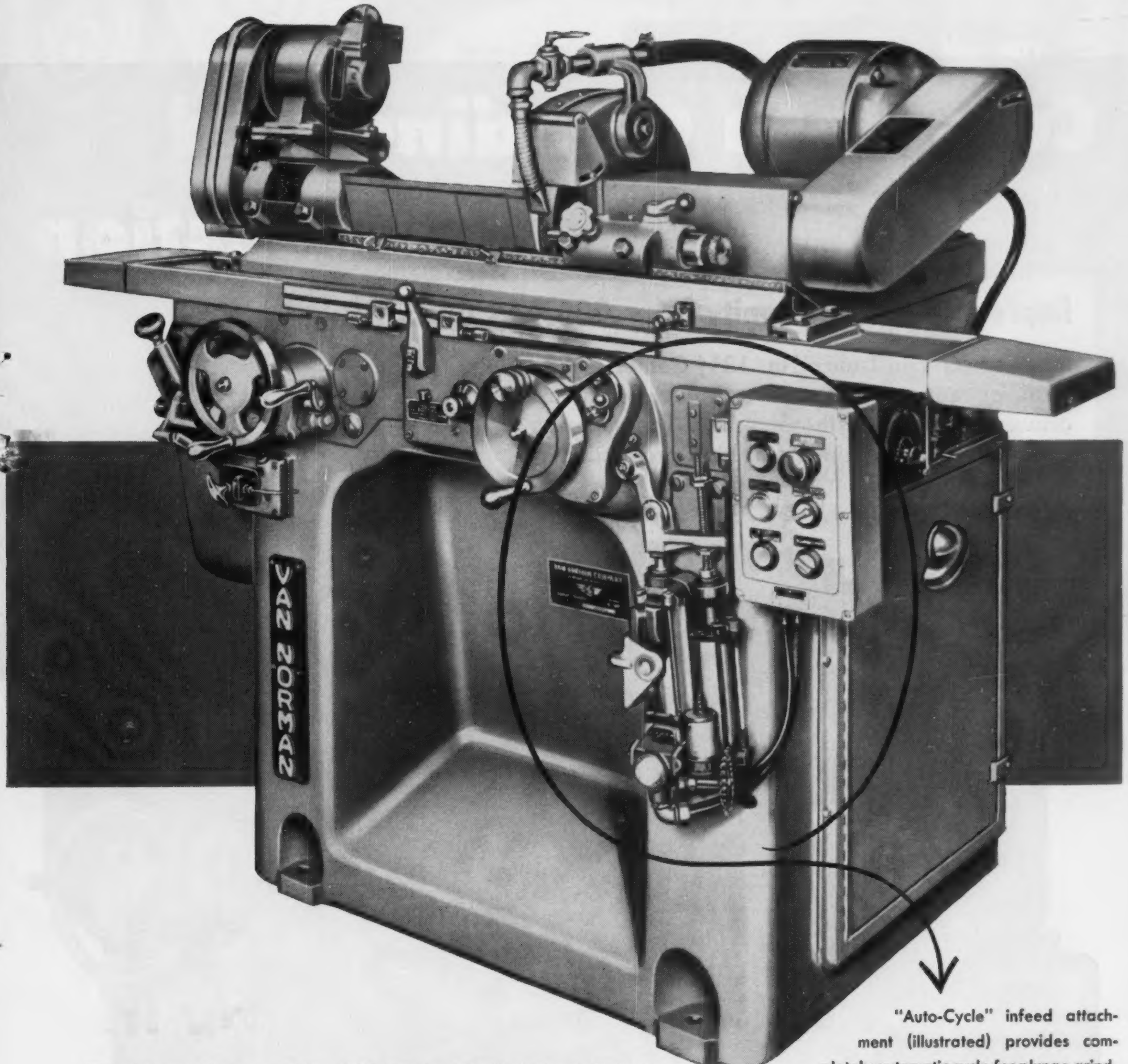
BOOTH
1205

*Note: HardClad is the trade name for the Cincinnati Lathe and Tool Co.'s flame hardened radial drill column.

**CINCINNATI**

**CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES**
**CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES**

For more information on products advertised, use Inquiry Card, page 235




"Auto-Cycle" infeed attachment (illustrated) provides completely automatic cycle for plunge grinding at low additional cost (optional). Work size 4" Diam. x 18" Long. Grinding Wheel 14" O.D. x 2" Wide. 2 H.P. Wheel Motor -- 3 H.P. Optional.

The Van Norman No. 418 Plain Cylindrical Grinder is especially adaptable for use in plants where work is in small or production runs where it will cut costs of plunge or traverse grinding of small parts. Set-ups are quick and easy . . . workpieces are easily loaded, ground and unloaded with minimum motion and effort. Call, wire or write for Bulletin giving complete details.

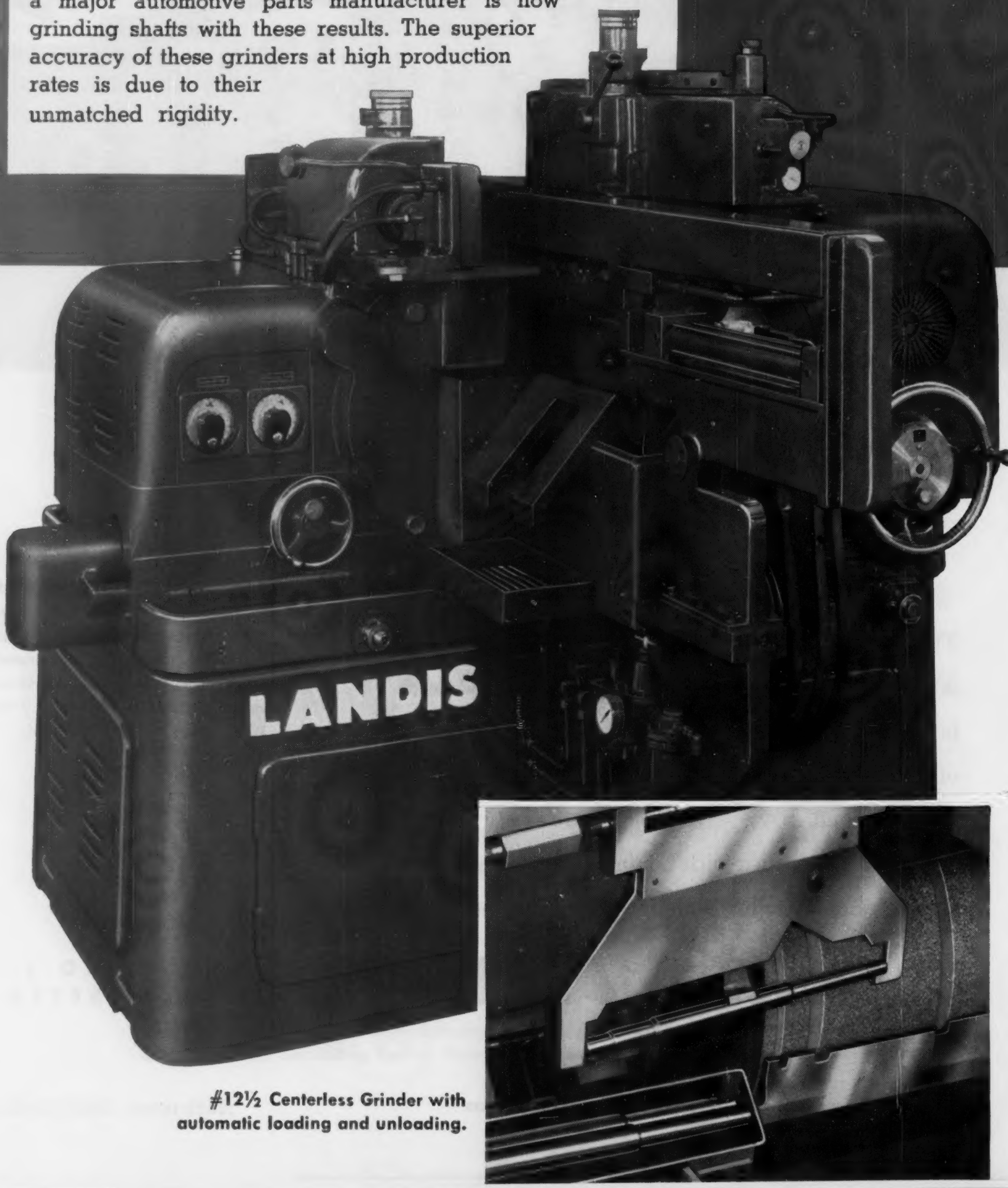
**COMPANY**

**SPRINGFIELD 7, MASSACHUSETTS**

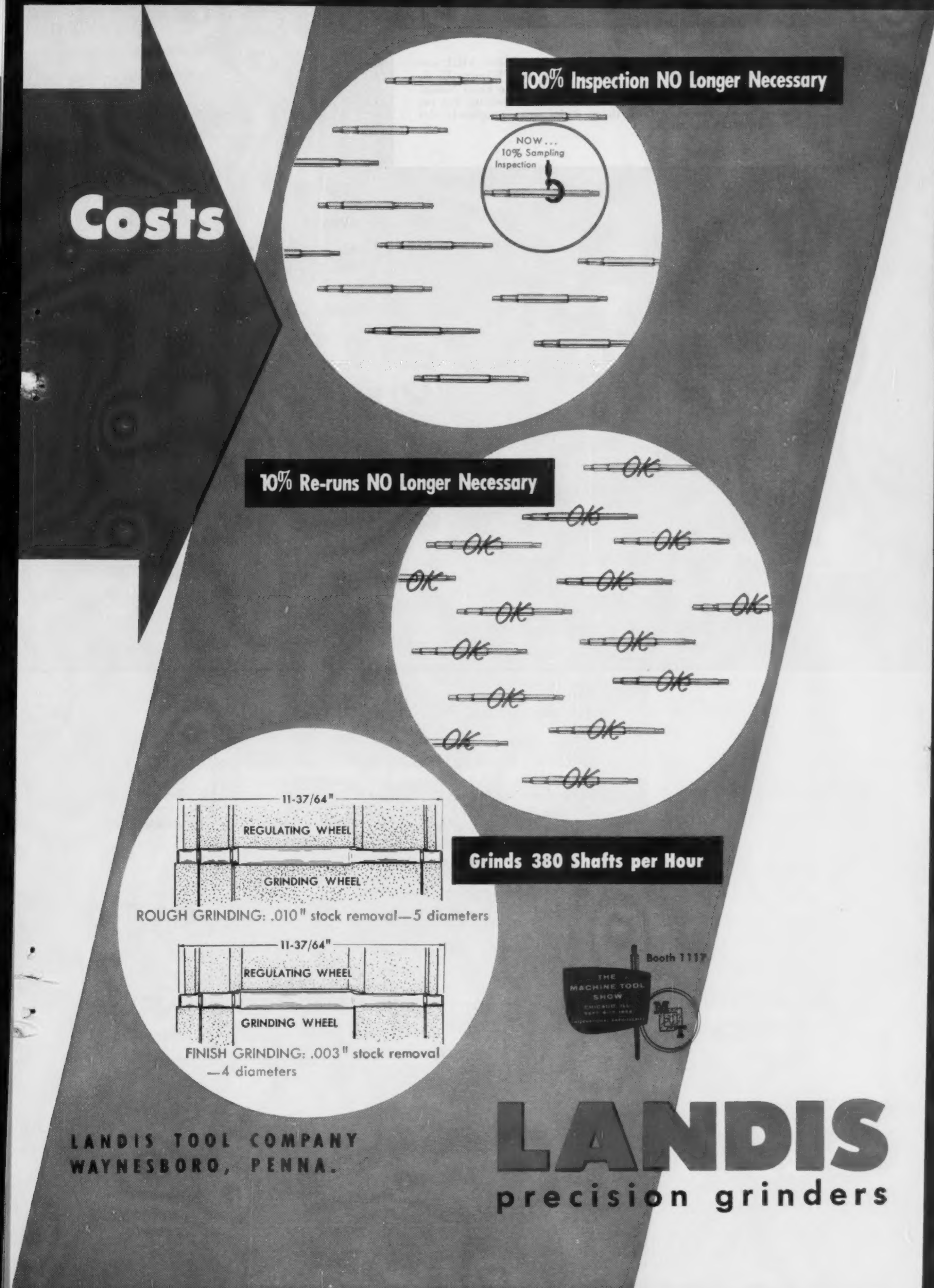
# Cuts Both Grinding and Inspection

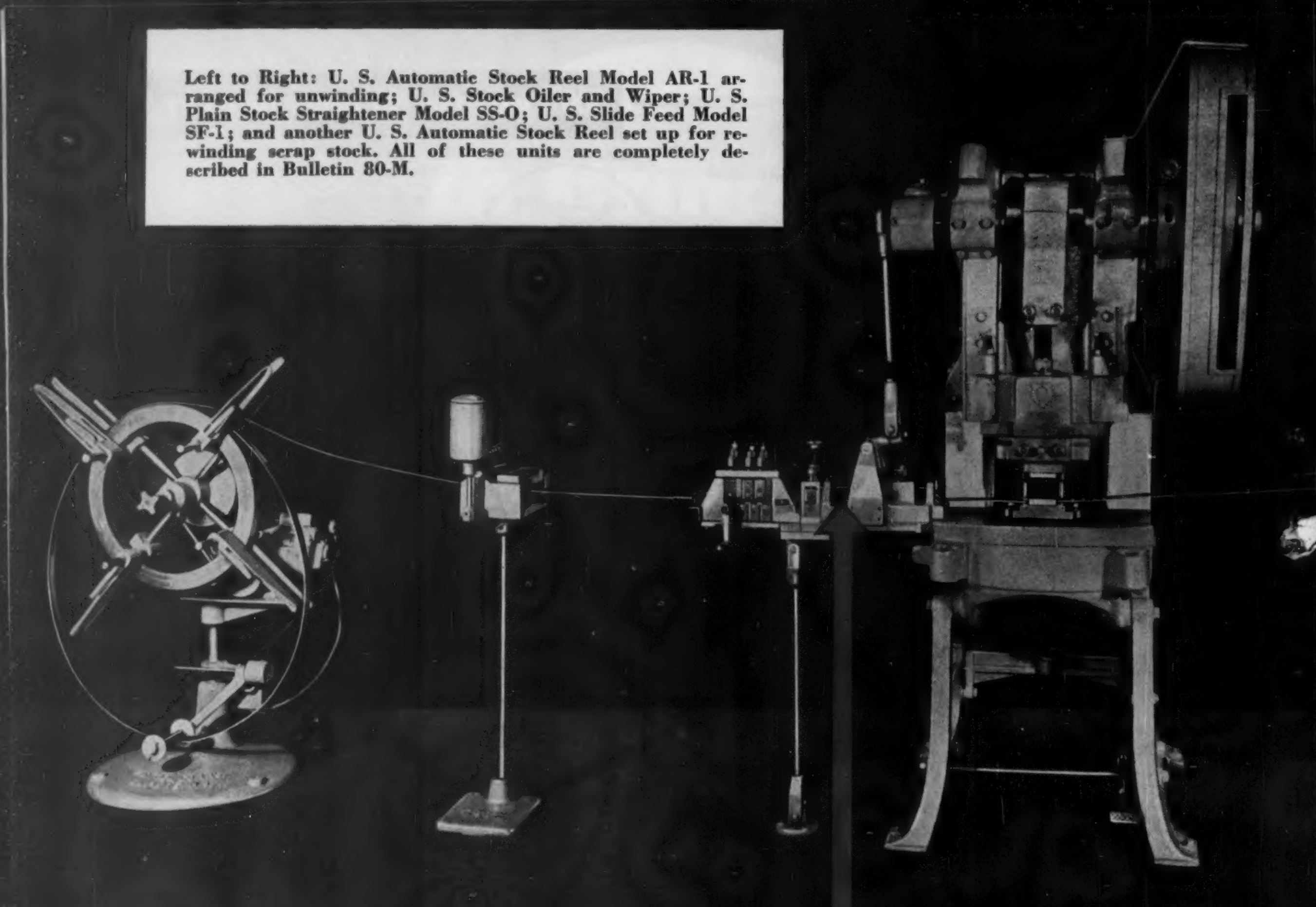
## Improves work uniformity from .0007" to .0003"

Since using two Landis No. 12½ Centerless Grinders, a major automotive parts manufacturer is now grinding shafts with these results. The superior accuracy of these grinders at high production rates is due to their unmatched rigidity.




#12½ Centerless Grinder with automatic loading and unloading.

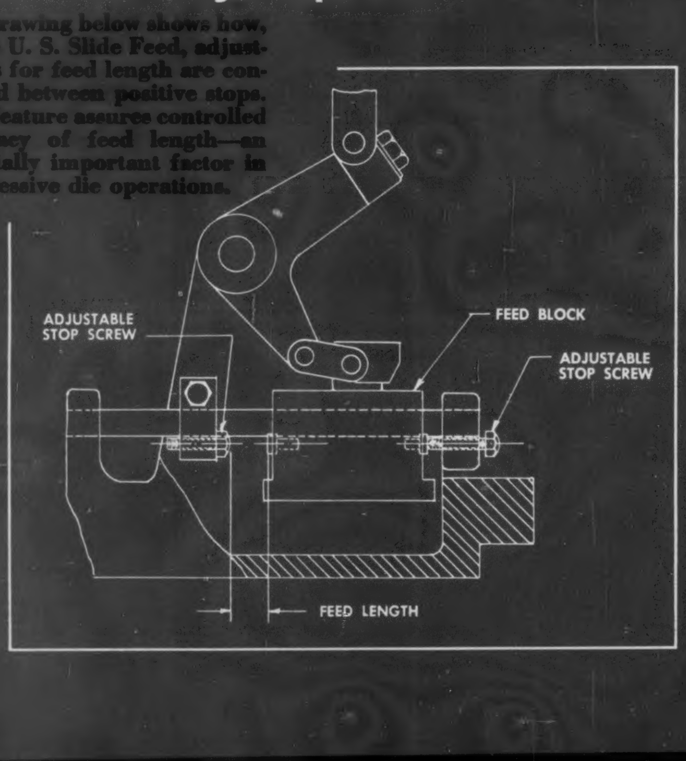

Costs
100% Inspection NO Longer Necessary
NOW... 10% Sampling Inspection
10% Re-runs NO Longer Necessary
OK
Grinds 380 Shafts per Hour
11-37/64"
REGULATING WHEEL
GRINDING WHEEL
ROUGH GRINDING: .010" stock removal—5 diameters
11-37/64"
REGULATING WHEEL
GRINDING WHEEL
FINISH GRINDING: .003" stock removal —4 diameters
Booth 1117
THE MACHINE TOOL SHOW
LANDIS TOOL COMPANY
WAYNESBORO, PENNA.
LANDIS
precision grinders

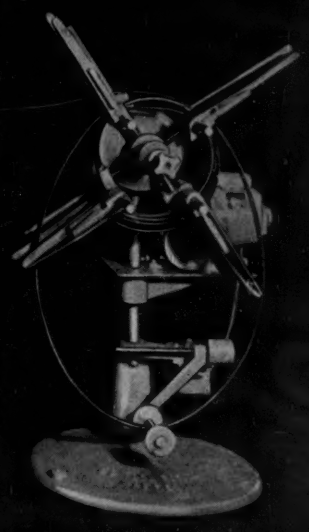


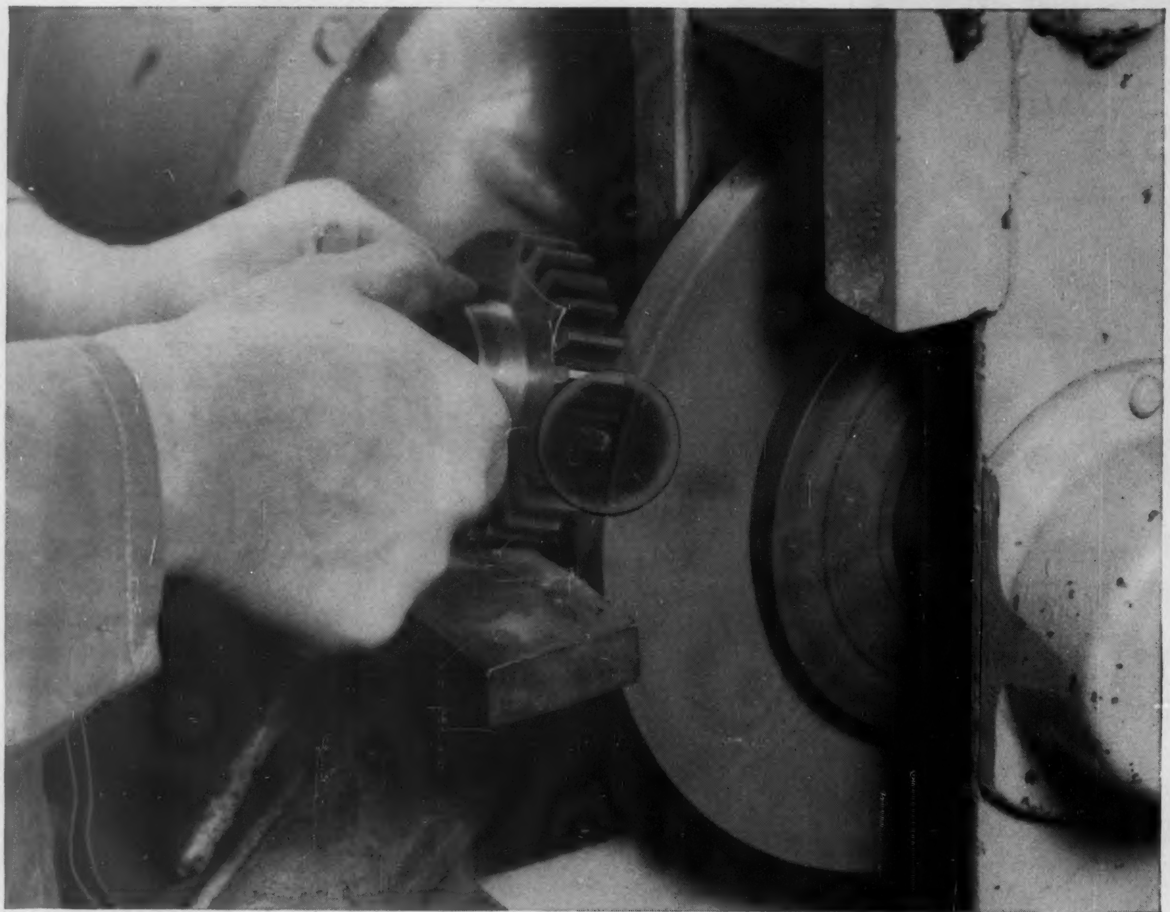
**Left to Right: U. S. Automatic Stock Reel Model AR-1 arranged for unwinding; U. S. Stock Oiler and Wiper; U. S. Plain Stock Straightener Model SS-O; U. S. Slide Feed Model SF-1; and another U. S. Automatic Stock Reel set up for rewinding scrap stock. All of these units are completely described in Bulletin 80-M.**

## Positive Feed Length Adjustment

**The drawing below shows how, in the U. S. Slide Feed, adjustments for feed length are controlled between positive stops. This feature assures controlled accuracy of feed length—an especially important factor in progressive die operations.**







**BF** — A universal favorite for removing light welds, breaking edges on machined work, deburring, taking off flash from plastic parts and many other light portable and bench grinding operations. To be used on periphery only.

# The jobs they do!...The money they save!

## *Norton Reinforced Wheels add the "TOUCH of GOLD" that cuts time and costs on countless everyday grinding jobs*

You get *more* than 100 cents' worth of usefulness for every dollar you spend on Norton Reinforced Wheels.

You get extra-long service life, exceptional strength and fast, cool, trouble-free grinding — the Norton-engineered "Touch of Gold" that saves you money in the widest range of routine grinding jobs, from ligh. deburring to heavy cutting-off.

To this top grinding performance Norton Reinforced Wheels add a wide margin of safety. All four are resinoid bonded and reinforced by layers of tough fabric molded into them. As follows:

**BF** — *Semi-flexible straight wheel, cotton fabric reinforcement. Also available in mounted wheels and points and hand sticks.*

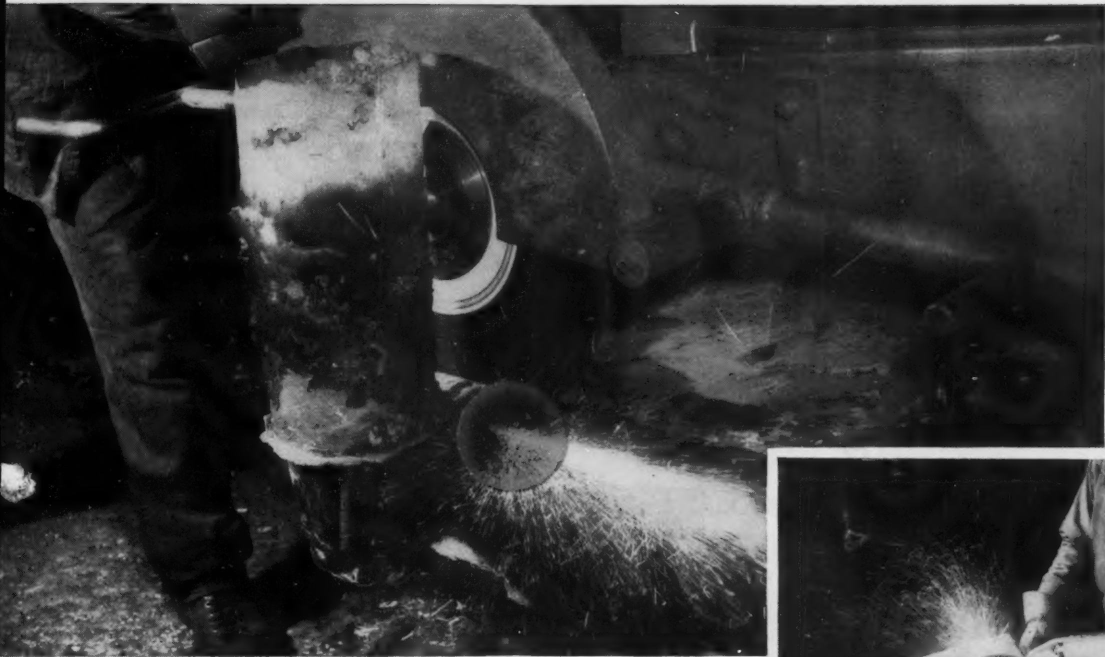
**BN** — *Straight wheel with glass cloth reinforcement. Primarily a cut-off wheel, its rough knurled sides provide additional cutting action.*

**BD** — *Rigid hub-type. Glass cloth and Nylon reinforcement. Designed especially for right angle portables and disc sanders.*

**BFR** — *Semi-flexible hub-type. Cotton fabric and Nylon reinforcement.*

**See Your Norton Distributor**

for a demonstration of Norton Reinforced Wheels in your shop, on the jobs you're doing every day. Ask him for the new, 34-page illustrated catalog on Reinforced Wheels. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your phone book, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.



**BN** — The preferred cut-off wheel for non-ferrous and non-metallic jobs. Also excellent for cutting wire rope, slotting rails, tuck pointing etc. Used on swing-frame and stationary cutting-off machines, large and small portables.

**BD** — A specialist in heavier stock removal, such as welds on fabricated work, smoothing flame-cut edges, cleaning between teeth of gear castings, etc. — also for slotting, notching and cutting-off.

**BF** — **Mounted Wheels and Points** have the same strong laminated construction as the larger BF wheels. For polishing die cavities, chamfering, Brinell spotting, etc. For hand finishing, use BF sticks.

**BFR** — Excels at the lighter portable jobs, such as rust and scale removal, light weld grinding, scarfing and beveling, blending contours, notching gates and risers.

W-1636

# NORTON

*Making better products... to make your products better*

*and its BEHR-MANNING division*

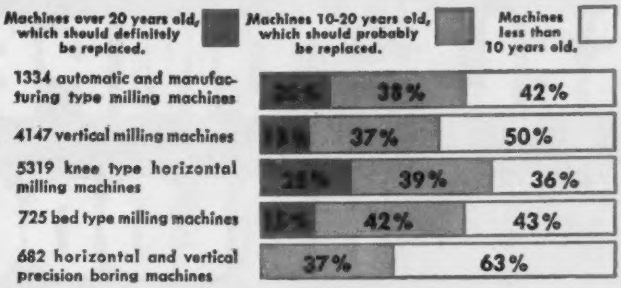
NORTON COMPANY: Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

For more information on products advertised, use Inquiry Card, page 235

# ONLY 68 CENTS PER HOUR

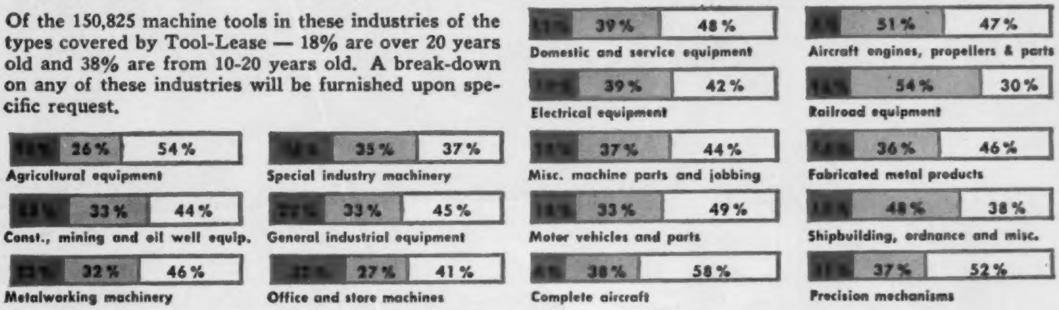
## LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE ELECTRICAL EQUIPMENT INDUSTRY

Includes machines for manufacture of wiring, instruments, motors, generators, transformers, switchboards, welders, transport equipment, lamps, radios, television, phonographs, transmitters, telephone-telegraph and other communication gear. Of the total 12,207 machines in use today which can be replaced by Tool-Lease equipment—18% are over 20 years old, 38% are 10 to 20 years old.




## HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.




*Figures adapted from 1953 American Machinist survey of metalworking industry*

WHERE high horsepower is the key to faster, better production for you—Kearney & Trecker's 20-30-50 hp CSM machines are your answer. You can get CSM's in plain or vertical styles for as low as 68 cents per hour — *and even less.*

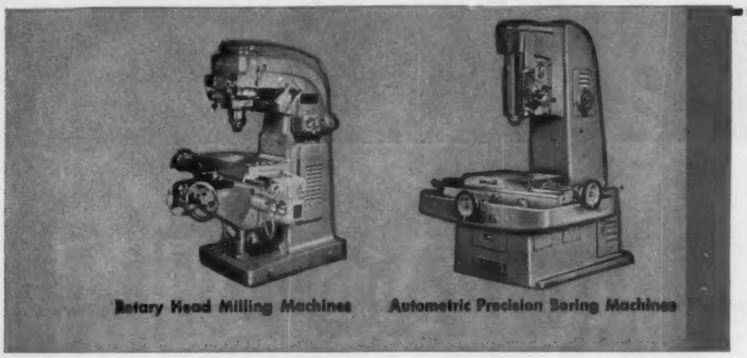
Under Tool-Lease Plan "A," one of three seven-year lease agreements offered by Kearney & Trecker, you make two semi-annual rental payments, totaling 25% of the machine's price during each of the first three years. Actually in dollars and cents, you pay only 68 cents per hour for a new 50 hp, Model CSM milling machine. That means a machine installed in your plant and in operation — *literally for pennies an hour!*

What's more, under Tool-Lease, you can rent any of over 250 different types and sizes of standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

For complete information on Tool-Lease, see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

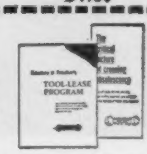
TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®





Rotary Head Milling Machines    Autometric Precision Boring Machines

KEARNEY & TRECKER CORP.
6784 W. National Ave., Milwaukee 14, Wis.
Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence."



Name........................................

Title........................................

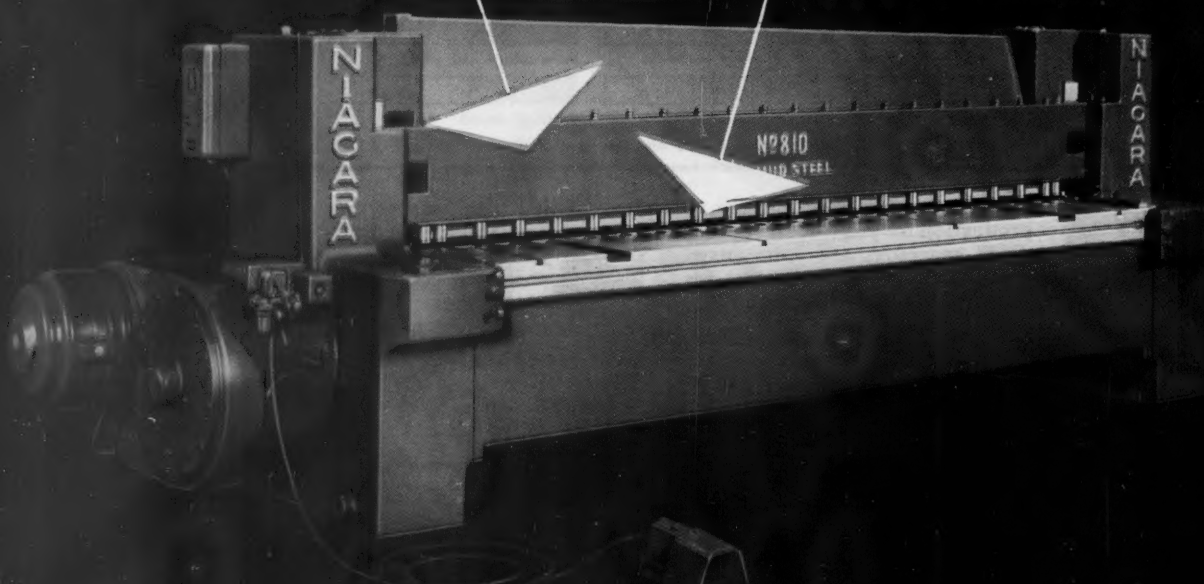
Company........................................

Address........................................

City........................ Zone........ State........................

For more information on products advertised, use Inquiry Card, page 235

# SELF-COMPENSATING HOLDDOWN

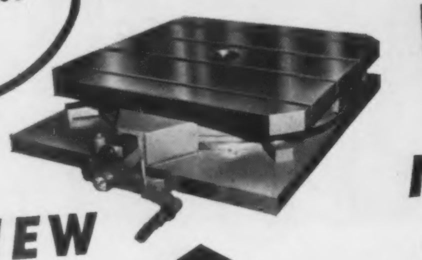


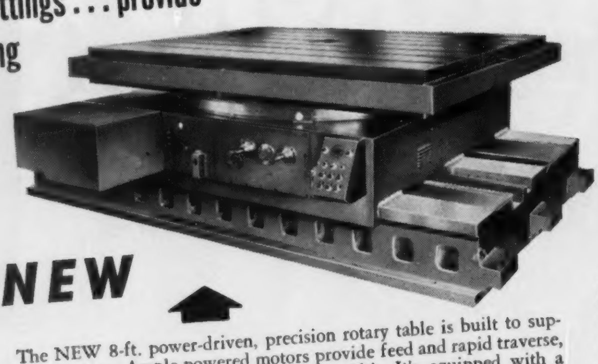
# Fast-Working

## G & L machine tool attachments and accessories

### Rotary Tables

**reduce number of work settings . . . provide rapid and accurate indexing**





**NEW**

NEW Giddings & Lewis Air-Lift rotary table eliminates multiple setups and is capable of 90° indexing off center loads. By turning a valve, air is forced into the unit, raising the table .001". With air acting as bearing, table "floats on air" . . . can be indexed to desired position . . . and firmly settles on non-lubricated seat. There's no oil film to disturb the accurate setting. Tables are available with round or square platens, both in 36" and 48" sizes.

**NEW**

The NEW 8-ft. power-driven, precision rotary table is built to support 50 tons. Ample powered motors provide feed and rapid traverse, and unlimited travel on 8-ft. runway width. It's equipped with a precision indexing device, graduated in .001".

Adaptability of this powered table enables the machine to do more jobs . . . eliminate numerous setups and the necessity for several special machines.

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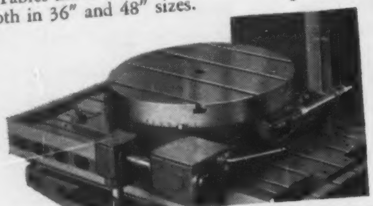


Giddings & Lewis plain or hand and combination power feed tables provide fast, accurate indexing and make it possible to machine a number of surfaces in a single setup. They're available in round, square and rectangular platens in various sizes.

Hand feed rotary tables — 24" and 30".

Plain rotary tables — 24", 30", 36" and 48" (round); 30", 36" and 48" (square).

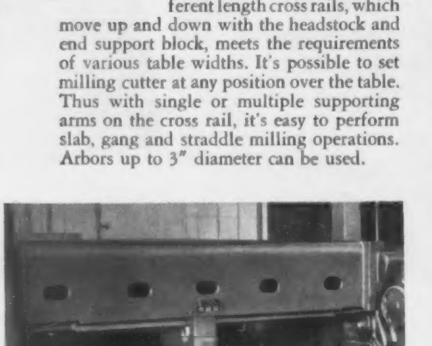
Combination plain, hand and power feed rotary tables — 36", 48" and 60" (round or square) and from 36" to 60" x 96" with intermediate sizes for rectangular platens.

### Angular Milling Attachments

**perform many different milling operations at various angles in a single setup**

**ARBOR SUPPORT (cross rail)**

This accessory unit with different length cross rails, which move up and down with the headstock and end support block, meets the requirements of various table widths. It's possible to set milling cutter at any position over the table. Thus with single or multiple supporting arms on the cross rail, it's easy to perform slab, gang and straddle milling operations. Arbors up to 3" diameter can be used.

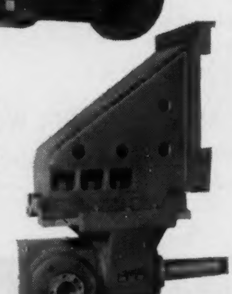


**MODEL A (single spindle)**

This 90° angular milling attachment offers unusual flexibility for machining hard-to-reach surfaces. Head swivels 360° in a plane at right angles to the machine spindle. Head flange is graduated in ½ degrees. Adaptors of different lengths permit placing of cutting tool from 24" to 42" from headstock.

Other angular milling attachments, not illustrated here, include light, medium and heavy duty (single and two-spindle types) and special models.

**MODEL D (sliding head)**



This right angle, sliding head, heavy duty head with a variable reach is practical for heavy milling, boring, drilling, reaming, etc. Provided with an adjustable overarm support, the head swivels 180° and may be extended up to 19".

Model F, medium duty, angular attachment is also available for machining operations at any angle in large openings and cavities. According to machine size, milling head may be extended 48", 60" or 72", and operates at same speed as machine spindle. Feed is obtained by spindle traverse.

# Profit-Makers!

## increase production... lower machining costs

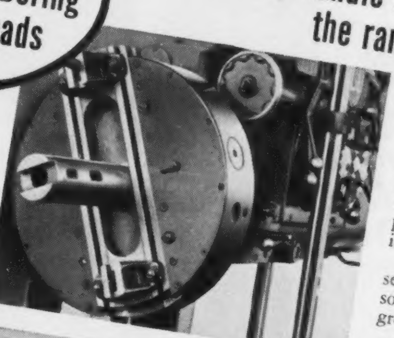
You get more production at lower cost and realize greater profits with Giddings & Lewis Horizontal Boring, Drilling and Milling machines when they're equipped with complete auxiliary attachments. It's common knowledge that no other machine can equal the wide variety of standard and unusual operations which a G&L machine can perform. Because it's so versatile, the operator can complete the job faster . . . considerably reduce floor-to-floor time . . . practically eliminate costly resetting and relocating of the work-piece.

Illustrated here are only a few of the attachments offered by G&L. If you're searching for an all-purpose machine plus a combination of profit-making attachments, call our nearest Giddings & Lewis representative. He'll give you all the details.

*Write for Literature:* Continuous Feed Facing and Boring Heads — A-10; Rotary Tables — A-20; Angular Milling Attachments — A-30; Set-Up Accessories — A-40.

### Continuous Feed Facing and Boring Heads

### efficiently handle a wide variety of operations well beyond the range of the machine spindle



This attachment is available for G&L Horizontal Boring, Drilling and Milling machines in 300, 30, 50 and 70 Series. Mounted on the machine headstock or on a line boring bar, it efficiently handles a variety of operations on circular flat surfaces, and external and internal cylindrical surfaces. It imparts a rotary motion with continuous feed. The tool slide is provided with six power feeds in both directions, independent of the spindle feed. A micrometer dial registers feed in increments of 0.001".

The Continuous Feed Facing and Boring head can be used separately or in combination with other attachments and accessories for turning, facing, counterboring, recessing, threading, grooving, forming, back facing, etc.

Also available are telescopic, right angle and facing tool holders, and a high speed grinder.

### Improved Measuring Device

Improved Measuring Device is for work where readings to 0.0001" are required as compared with readings to 0.001" permitted by the standard machine scales and verniers. For use with G&L Table Type machines only, the device allows for extremely precise measuring of vertical travel of the headstock and cross travel of machine table on the saddle. A similar device for measuring saddle movement can also be supplied. Precision end rods for use with the device are available in complete sets or as individual units.

### Box-type angle plates and parallels

Parallel block | Box-type parallel | Box-type angle plate

Parallel blocks and box-type parallels are precision machined for both squareness and parallelism. They're available in a broad range of sizes — solid block of alloy steel; ribbed, close-grained cast iron, and full box-type with T-slots on top and sides.

Box-type angle plates, made of one-piece castings, are available for precision milling or boring vertical surfaces of workpieces, either at right angles or parallel to the machine spindle. T-slots and locating keyways are planed to close tolerances.

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

BOOTH NO. 710

**GIDDINGS & LEWIS MACHINE TOOL CO.**

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

For more information on products advertised, use Inquiry Card, page 235

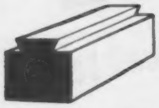
# Never Confuse the No. 8 MARVEL with an ordinary Band Saw

## ...only the MARVEL is Universal

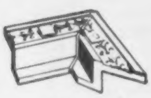
Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.


Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.

Only a No. 8 MARVEL can do all of these things: Snip-off a ⅛" rod or cut-off an 18" x 18" cross section

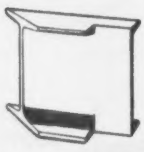


Rough to Size and Shape

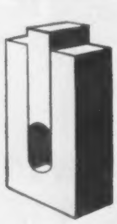


Miter

Index



cut off and shape Structural Beams.



Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures; Etc.

### "Rough Machine" to size and shape with minimun chip waste

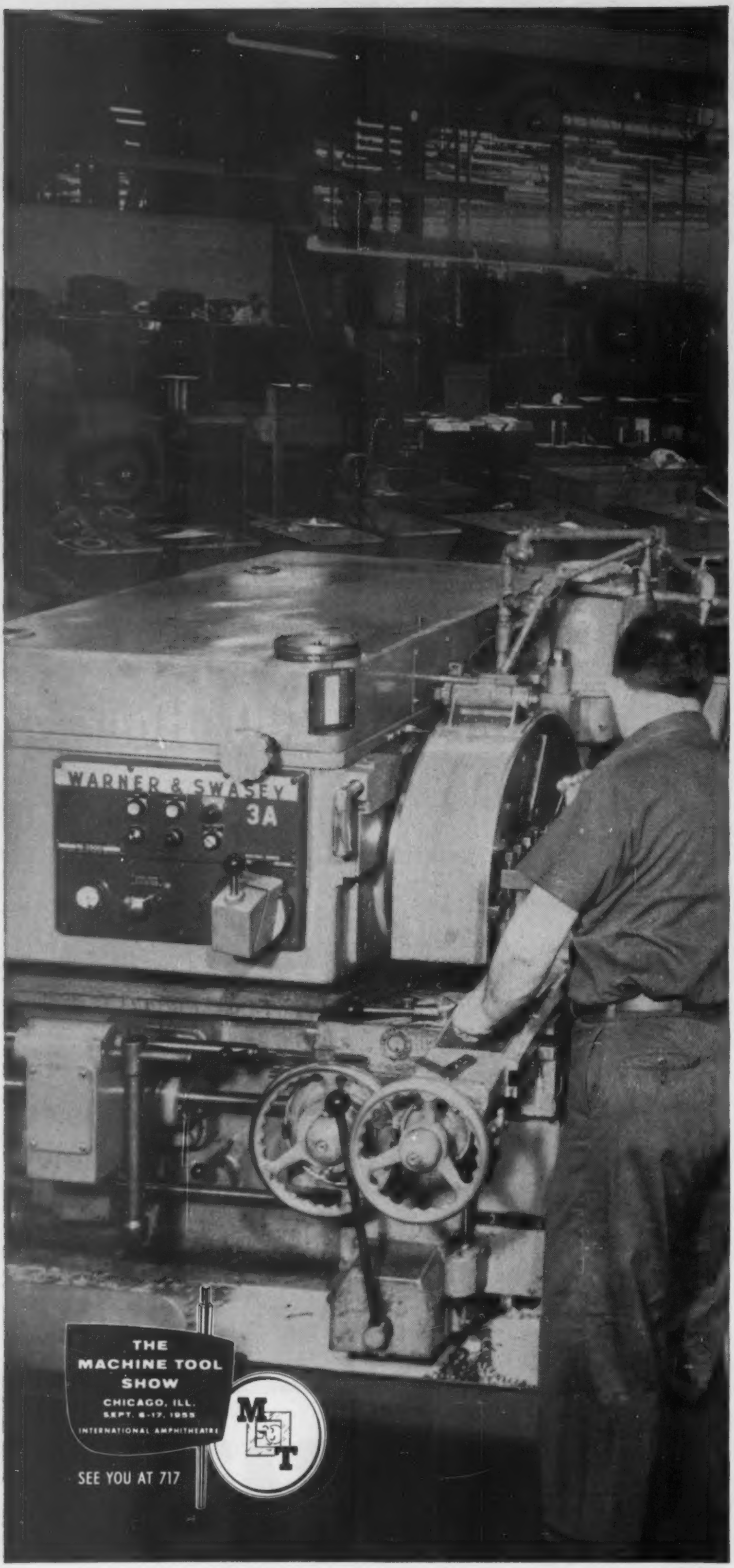
The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.

MARVEL *Metal Cutting* SAWS

Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.




# Warner & Swasey 3-A's show 5-way production gain for Goss!

You've read all about the features – now here are *performance facts* about the new, extra-heavy duty Warner & Swasey saddle type turret lathes.

This report comes from Goss Printing Press Company who selected two new Warner & Swasey 3-A's for small-lot, high precision printing press parts. These machines, part of their dynamic replacement program, replaced two 1941 turret lathes.

In this business machining accuracy requirements are high, for giant roll presses must print up to 2,000 feet of paper per minute – and the only guide for this ribbon of paper is the parallelism of the rolls to each other.

Here are the performance factors that Goss reports speeded production and added up to *30% savings* from their new Warner & Swasey installation:

**Higher top speed** of 851 rpm. makes it possible to maintain recommended surface speeds on more work diameters. Before, only the larger diameters could be machined at recommended speeds.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS . . . WITH A

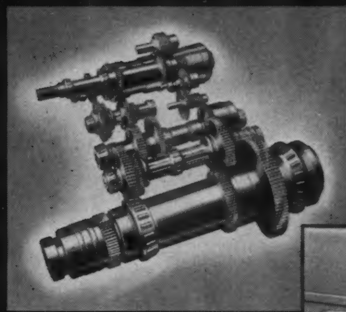
**More speeds quickly available in their working range.** Because of Goss' small lot production, averaging about 10 pieces, work diameters vary from small ¾" bores all the way up to maximum machine chucking capacity. The Warner & Swaseys' 32 easily-obtained speeds permit selection of the right speed for the particular cut. Instead of two or three speed changes per job, they are now more likely to make four or five.

**Built-in accuracy and rigidity** has made it possible for Goss operators to eliminate the non-productive time previously necessary for "inspections" to maintain specified tolerances. Now entire lots are run with only spot checks after the first piece. They bore 3½" diameter sleeves 12" long to within a .0005 end-to-end taper tolerance, and within .0005 total tolerance on the bore! Previously such bore tolerances required reaming. Improved tool life is also attributed to the machines' greater rigidity. Feeds and depth of cut have, at the same time, been increased.

**Increased horsepower** now permits running all jobs at recommended surface speeds of 400 surface feet *and higher!* It has also permitted more frequent use of combined and multiple cuts, again saving machining time.

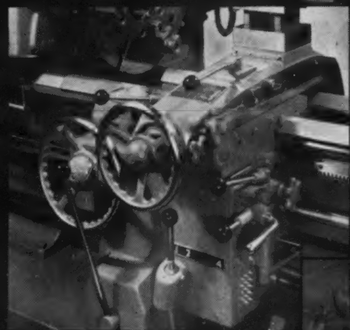
**Handling ease** of the new 3-A's has them all talking in the Goss shop! They'll tell you about the new automatic headstock, with its shifting ease and direct reading preselector dial. Operators like the time and effort saved by the power chuck wrench, and praise the machines' single rapid traverse on the cross slide apron, and the zoned controls.

That's the Goss report. And if you've read "between-the-lines" production advantages for *your* shop, call in our Field Engineer for more facts!

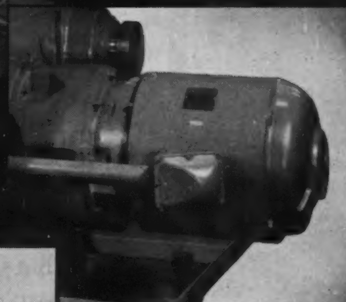


**New 16-SPEED HYDRAULIC DRIVE** provides closer grouping of speeds in natural work range — 32 unduplicated speeds with two-speed motor!

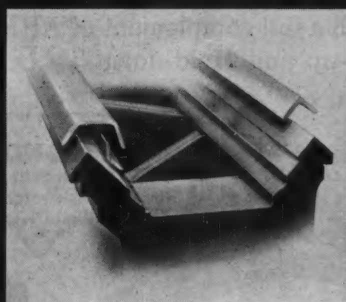

**New SPEED PRE-SELECTION** by direct reading dial while under cut. Effortless AUTOMATIC GEAR SHIFTING by single lever.



**New ZONED CONTROLS**—single lever rapid traverse on cross slide apron. All controls on apron and headstock grouped within easy reach.



**New POWER**—as much as you'll need for any job! Motor ranges: 1-A, 15-30 hp. 2-A, 20-40 hp. 3-A, 30-60 hp. 4-A, 40-75 hp.



**GREATER RIGIDITY AND ACCURACY** from induction hardened Vee-ways and gib design, plus scientific diagonal rib design of bed—all Warner & Swasey exclusives!

75TH ANNIVERSARY YEAR
WARNER & SWASEY
*Cleveland*
PRECISION MACHINERY
1880 — 1955

**WARNER & SWASEY**

For more information on products advertised, use Inquiry Card, page 235


ARMSTRONG
SET-UP
AND
HOLD-DOWN TOOLS
ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.
Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.
Write for Circular
Buy ARMSTRONG TOOLS from your Industrial Distributor
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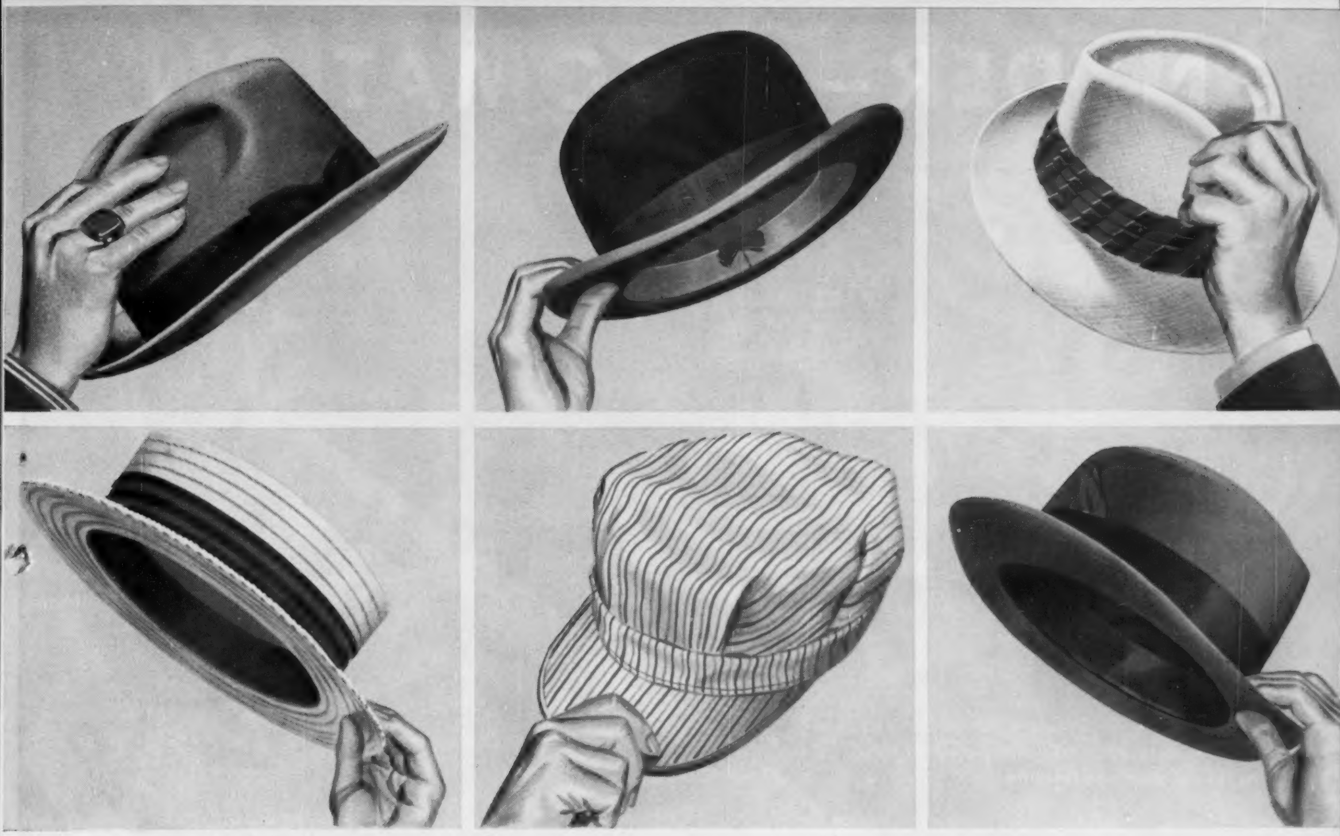
STRONG
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5213 W. ARMSTRONG AVE.
CHICAGO 30, U. S. A.



# Why hats are off to CIMCOOL...

**. . . because CIMCOOL° has become, in just a few years, the largest selling cutting fluid in the world.** And sales of this radically new and different coolant are continuing to climb because CIMCOOL Standard Concentrate has two big advantages over old-fashioned cutting fluids:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and increases tool life, for it combines friction reduction and cooling capacity in a degree never before attained.

We'll be happy to supply information on the many specific advantages of CIMCOOL Standard Concentrate—or details on the entire family of CIMCOOL Cutting Fluids. Just contact us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Wire, write, or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

### CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Base Additive** — For jobs requiring an oil-base cutting fluid. Added to mineral oils, it gives an economical mix for speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity.

CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

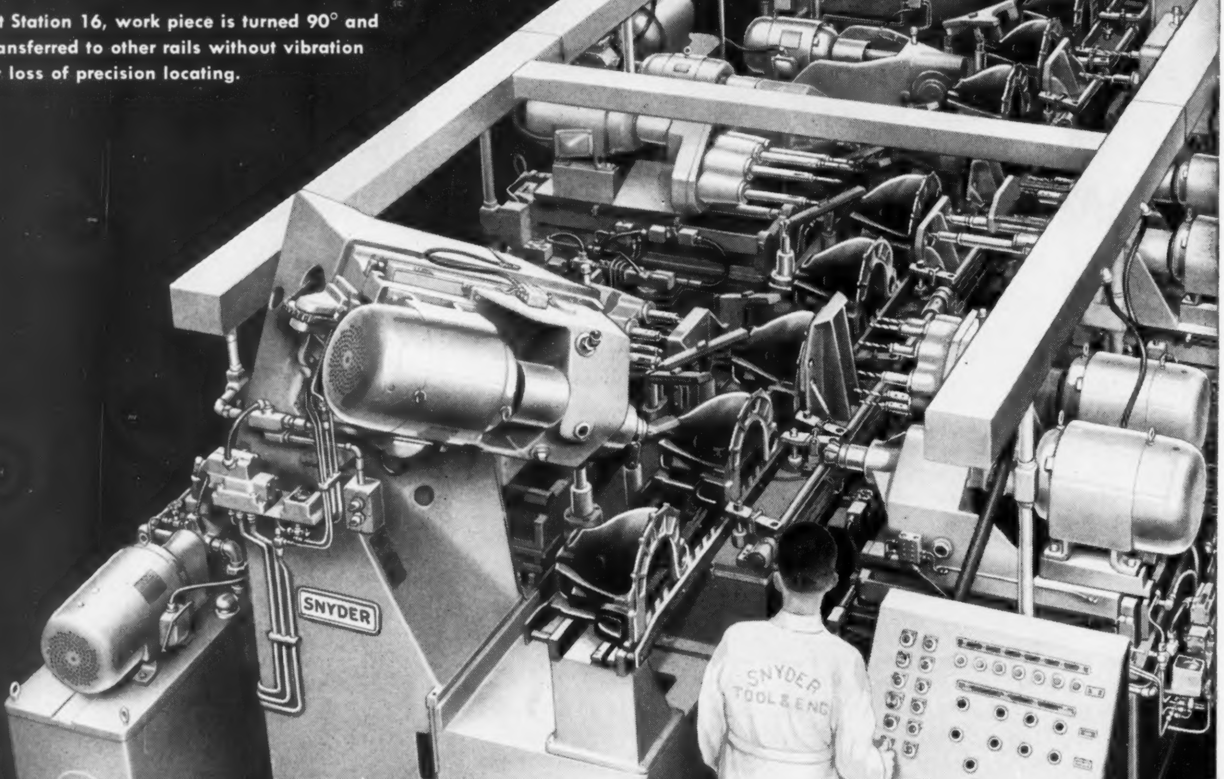
**CIMCOOL**
**Cutting Fluids**

*for ~~85%~~ 100% of all metal cutting jobs*

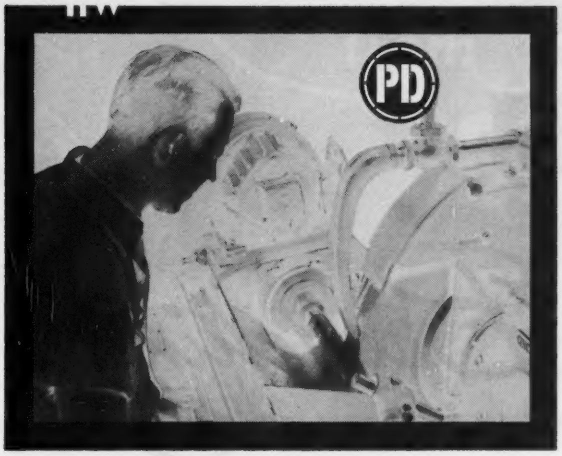
PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

# SNYDER—AUTOMATION

At Station 16, work piece is turned 90° and transferred to other rails without vibration or loss of precision locating.



# The most important grinding wheel development in years...





JUST AS A NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a POSITIVE DUPLICATION of an original grinding wheel each and every time through the CINCINNATI (PD) Manufacturing Process.

# NOW!

## Cincinnati Grinding Wheels offer

PD

# Positive Duplication

When you see what Positive Duplication can do for your plant, you'll agree that here is a truly remarkable development.

*Positive Duplication is an achievement in precision manufacturing and quality control that absolutely can save you money . . . and increase your production.*

Through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

*Yet* CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

We'll be glad to prove to you how CINCINNATI (PD) WHEELS can save you money and increase your production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division. The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI
*Grinding Wheels*

A PRODUCTION-PROVEN PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

For more information on products advertised, use Inquiry Card, page 235

# Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

THE MACHINE TOOL SHOW CHICAGO, ILL. SEPT. 6-17, 1955 INTERNATIONAL AMPHITHEATRE

BOOTH 1413

The Gisholt MASTERLINE medallion will identify this new and improved series of machines to be shown for the first time at the Machine Tool Show in Chicago in September. See them at work in Booth 1413.

## PRE-SHOW ISSUE

# SINGLE PASS *JETRACER* IS DOUBLE-TOOLED TO SPEED PRODUCTION

### *Unique Setup on No. 12 Automatic Lathe Cuts Costs on Differential Gears*

Jobs like this may open your eyes to some new money-saving ideas with the Gisholt *JETRACER* unit. Here's how this manufacturer does it:

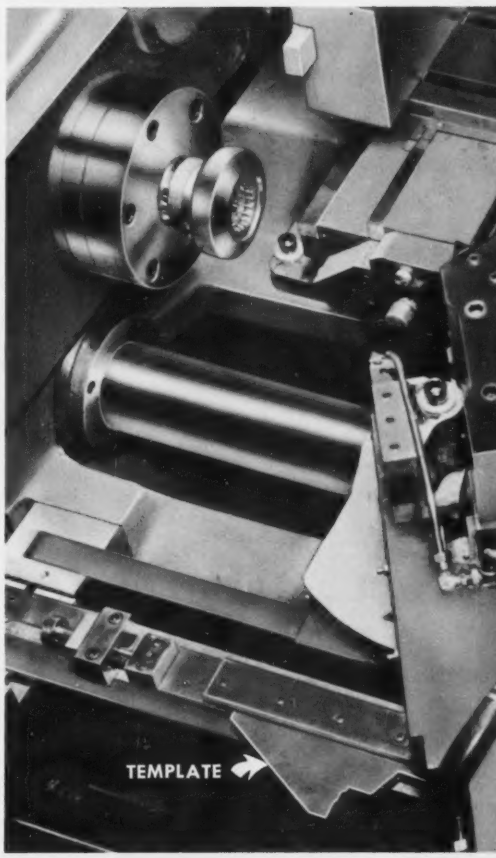
To machine steel forgings for differential gears, two No. 12 Automatic Lathes are equipped with *JETRACER* units, both of which are double-tooled. Gears are held on a segmented-sleeve type air-operated expanding mandrel and driven by a key in the splined I.D. Double-tooling on both tracer slides makes it possible to complete each operation in a single pass.

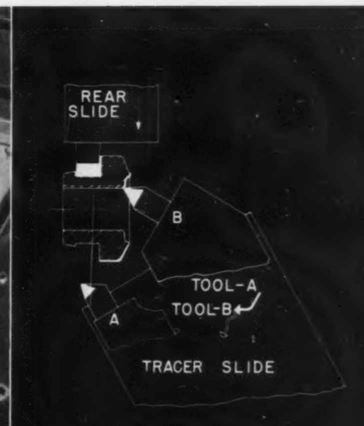
The line drawing illustrates the first operation. Tool "A" faces the bevel, chamfers the edge and turns the O.D. As tool "A" completes its cuts, tool "B" engages work, facing, co-boring, facing the co-bore and chamfering the corner of the splined I.D. Meanwhile, the rear slide feeds in with a single tool to face the back of the flange and shave-turn part of the hub. Floor-to-floor time is a fast 0.8 minute.

The second operation on the other end is completed in the same manner on the second No. 12 Automatic Lathe, also in 0.8 minute. One operator handles both machines to keep production humping.

***It's the combination of smart tooling on the JETRACER unit with the speed of the No. 12 Automatic Lathes that accounts for the swift, accurate production of these parts.***

(*If you'd like to see more cost-cutting* JETRACER *applications, ask for folder —Form 1171.*)




Layout for 1st operation

Work piece for 2nd operation

Machining of these differential gear blanks is done with setup shown in drawing. Tools on tracer slide engage in quick succession while simultaneous cut is made with rear slide. Note template for tracer follower at bottom of machine photo.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

## At the SHOW:

No. 12 and 24 AUTOMATIC LATHES—See single and multiple passes with *JETRACER* Unit. Three new models; one with full automation.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

***THE SHOW . . . SEE GISHOLT!***

## SEE THE MASTERLINE AT

TIME-SAVING IDEAS

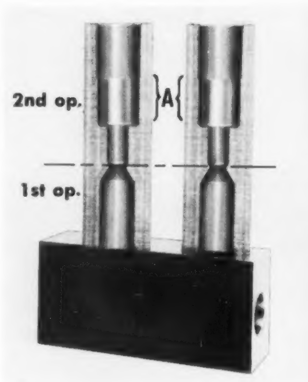
# CUTS COSTS BY COMBINING INTERNAL MACHINING AND BURNISHING

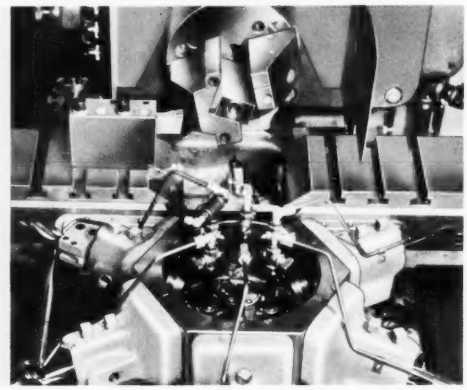
### *Fastermatic Automatic Cycle Is the Answer*

To cut costs on these steel block check valve bodies, the producer wanted them internally machined and burnished in two sequential operations on two 1F Fastermatic Automatic Turret Lathes.

By using a special two-jaw air chuck, the job was quickly and simply accomplished. Used for both operations, the special chuck has one stationary jaw, V-block shaped, to locate the work on center, with a dead stop at the rear for longitudinal location. The second jaw clamps the piece by moving in and out.

In the first operation, the valve seat is drilled, formed and reamed; the large bore is taper reamed; and the valve body is faced on one end. Time: 1.46 minutes. In the second operation, the other end of the piece is drilled, bored, co-bored, chamfered and reamed. The operation is then completed by feeding a special turret-mounted burnishing tool into bore "A" to obtain a 20 micro-inch R.M.S. finish. Time: 1.78 minutes.





With a minimum of special equipment, the Fastermatic incorporates the internal burnishing operation as part of the automatic cycle.

***Total time for the first operation is only 1.46 minutes, and only 1.78 minutes floor to floor time is used for the second operation—including burnishing bore "A" to a 20 micro-inch R.M.S. finish.***

**AT THE SHOW:**

FASTERMATICS—continuous automatic operation. New setup features make small lot production economical with simple, fast changeover.

# TWO CHUCKS ON SADDLE TYPE LATHE HANDLE LONG WORKPIECES

### *Long oil well drill tubes machined quickly, easily with this setup*

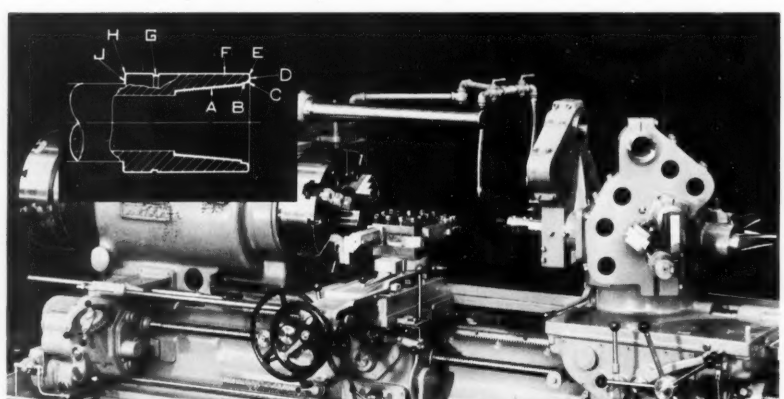
What's the fastest, easiest, safest way to hold an oil well drill tube and machine on end?

Here's one way of doing it:

The long tube is "double-chucked" in a 4L Saddle Type Turret Lathe, using two 24" 3-jaw scroll chucks, one at front and one at rear of the spindle. Result: whip is prevented; distortion is avoided.

Machining is low-cost and simple. First, "D" is faced from the square turret. Next, "A" is step-bored from two multiple-tooled stations on the hexagon turret, which also rough and finish co-bore "B," chamfer "C" and "E" and turn "F." Two more stations on the hexagon then rough and finish taper ream "A," and a special holder on the square turret simultaneously grooves "G," chamfers "H" and faces "J."

"A" is then single-point threaded, using the full-length lead screw and a special taper attachment cam on the square turret carriage. This completes the job.




***Machining long workpieces without whip and distortion is simple, fast and easy with this two-chuck setup on a Gisholt Saddle Type Turret Lathe.***

**AT THE SHOW:**

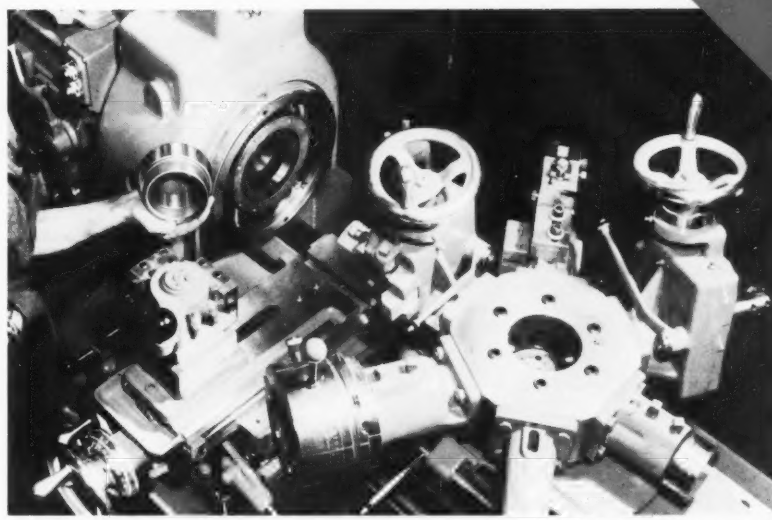
SADDLES—new higher speed, more powerful machines. *JETRACER* will be demonstrated on both bridge type cross slide and hexagon turret mounting.

*LOOK AHEAD... KEEP AHEAD... WITH GISHOLT*

***THE SHOW . . . SEE GISHOLT!***

BOOTH 1413

# HERE'S EXTRA SPINDLE BORE CAPACITY WITH OUTSIDE-OPERATED COLLET CHUCK



Here's a good idea to keep in mind: You can work right up to the limit of your spindle bore capacity. This producer is doing it with his Gisholt No. 5 Ram Type Turret Lathe, tooled to machine threaded adapter bushings from $4\frac{5}{8}''$ seamless steel tubing. An outside-operated collet chuck does the trick.

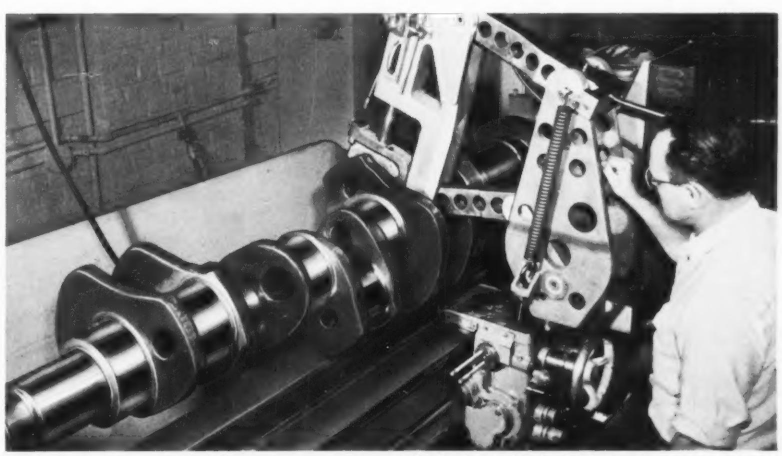
Tooling is also well planned. Parts are finished in minimum time—only 4.2 minutes floor to floor. Hexagon turret tools bore, co-bore, turn, form, chamfer, thread the O.D. and tap the I.D. Square turret tools face and chamfer with cut-off from the rear tool post.

***An outside operated collet chuck arrangement provides the extra capacity needed to complete this job and permits using a smaller, less expensive machine.***

**AT THE SHOW:** See new Ram Type models, including the $4\frac{1}{2}''$ spindle bore No. 5. Also, first showing of the new Electram for high-speed, automatic operation on small parts.

# HOW TO SUPERFINISH CRANKSHAFT BEARINGS ON A LATHE

***No. 4 attachment makes possible smoother surfaces with very small investment***



Even on limited production, you can take advantage of the benefits of Superfinishing. Attachments can be mounted on your own lathe, thus saving the cost of a special machine. In this case, large diesel engine crankshafts, main and pin bearings are Superfinished in one operation. Costs are held low by a Superfinishing attachment with a special latch-on type, follower-arm.

Nine bearing surfaces are Superfinished with four minutes stone contact time per bearing and one minute to position the attachment for the next bearing. A final surface finish of 3 to 5 micro-inches R.M.S. is attained, compared to 25 to 30 micro-inches R.M.S. before Superfinishing.

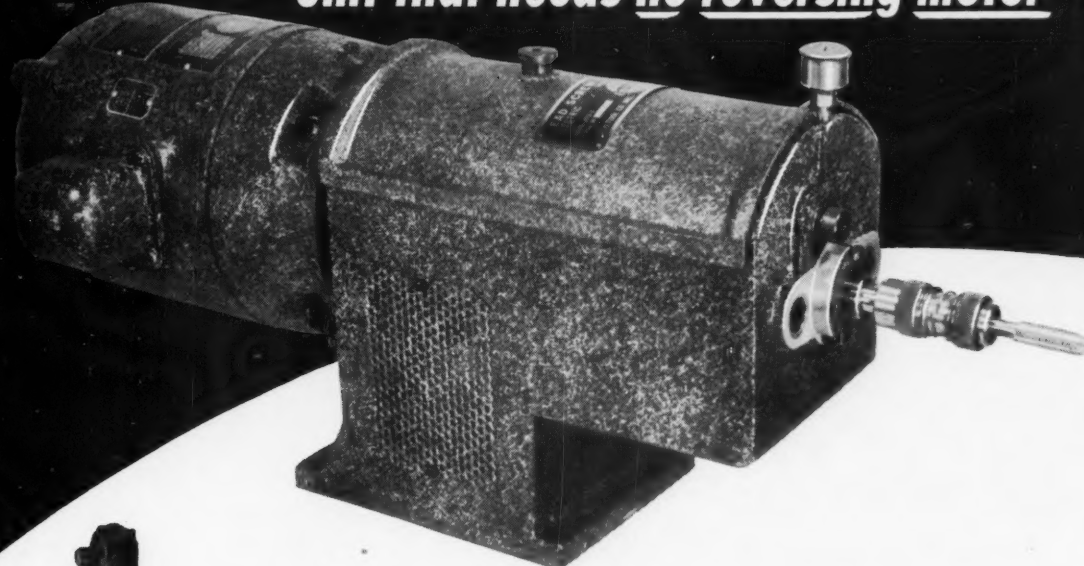
***This special Superfinishing attachment on existing equipment eliminates polishing and lapping operations to insure better crankshaft performance.***

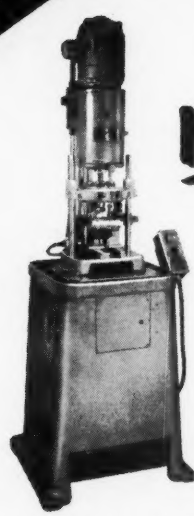
**AT THE SHOW:**

SUPERFINISHERS—machines working continuous runs and job lots. Demonstrations to show reasons for Superfinish and how to control size.

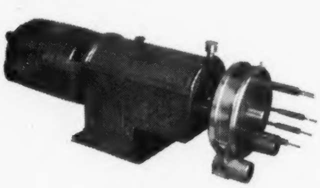
*TALK TO GISHOLT ABOUT MACHINE TOOL LEASING*

# Now ...an all electric completely self-contained lead screw tapping unit that needs no reversing motor





A.T.U. No. 3 Lead Screw Tapping Machine with Ettco-Emrick multiple spindle head and work holding fixture—the ultimate in tapping speed and economy.



A.T.U. No. 3 Lead Screw Tapping Unit with Ettco-Emrick multiple spindle tapping head.

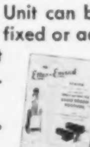
## New ETTCO-EMRICK A.T.U. No.3

### with forward and reverse electric clutches

Fastest, most accurate and simplest method of lead screw tapping yet devised! The Ettco-Emrick A.T.U. No. 3 Unit utilizes a new principle of instantaneous acting electromagnetic forward and reverse clutches to make the tapping operation as easy and as automatic as it could possibly be. Check these features:

1. All electric operation and control — no cams, no air, no hydraulic systems. Easily synchronized to any machine.
2. No reversing motor required — electro-magnetic forward and reverse clutches control tap direction.
3. Built-in rheostat control permits torque of clutches to be adjusted over a range of from 0 to 2 hp to give sensitivity required to protect smallest taps yet assures sufficient power and torque to drive the larger taps.
4. Thread depth control to within ¼ turn of the tap.
5. Lead screws and nuts for different pitches which can be quickly and easily interchanged simply by removing two set screws.
6. Unit can be operated in any position — horizontal, vertical, at any angle.

In addition to single spindle operation, the basic A.T.U. No. 3 Unit can be incorporated into a variety of tapping set-ups using Ettco-Emrick fixed or adjustable spindle multiple heads, work holding fixtures, etc. to meet an almost limitless range of tapping and threading requirements.



***Bulletin No. A.T.U. has details. Send for a copy.***

## ETTCO TOOL CO., INC.

Ettco-Emrick

**592 Johnson Ave., Brooklyn 37, New York**

Chicago • Detroit • Menlo Park, Calif. • Worcester
Distributors throughout the U.S. and Canada

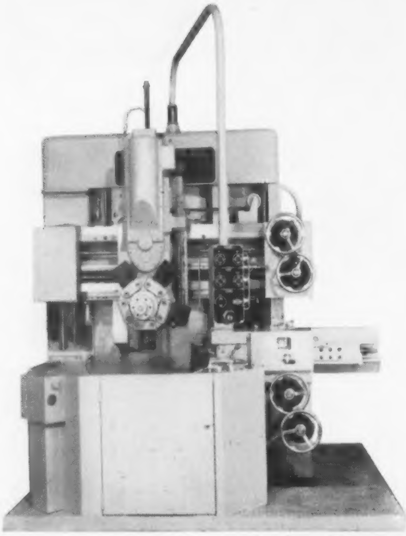
**TAPPING ATTACHMENTS • MULTIPLE HEADS • TAPPING MACHINES • INDEXING FIXTURES • TAP AND DRILL CHUCKS**

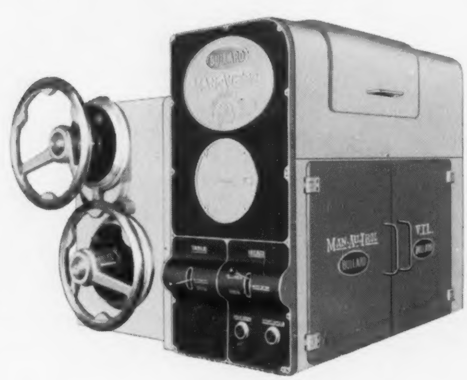
For more information on products advertised, use Inquiry Card, page 235

# Machine Tools for *Today*. . .

## The most versatile vertical turret lathe available to the metalworking industry

## Man-Au-Trol, Model 75 . . .





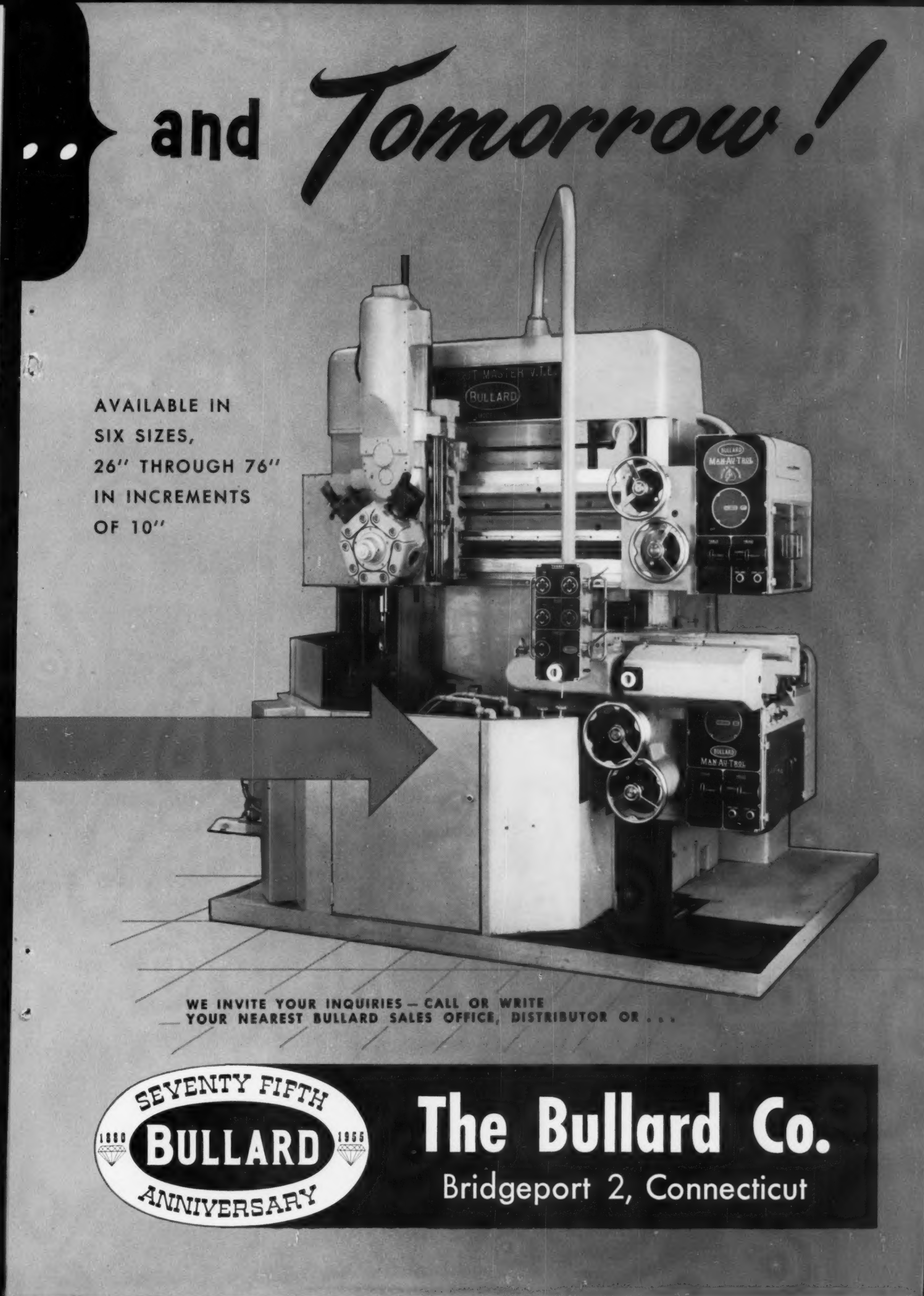
Versatile because at the time of purchase should your production output require only a Cut Master V. T. L., Model 75 and later increase so that automatic operation is desirable, a Man-Au-Trol Conversion Unit can be added to the Cut Master right in your plant.

The Man-Au-Trol Conversion Unit directs the machine through all the functions the machine is capable of performing—automatically—by use of control and function drums. Machine down time for job change-over is reduced to a minimum since the control drum can be pre-set in advance and placed in the machine in a matter of seconds.

Your Bullard Sales Engineer will be glad to fully explain all of the technological advantages that are incorporated in the Man-Au-Trol, Model 75 and apply them to your machining problems.

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

PLAN TO VISIT OUR EXHIBIT AT BOOTH 1213


. . . and Tomorrow!
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SIX SIZES,
26" THROUGH 76"
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YOUR NEAREST BULLARD SALES OFFICE, DISTRIBUTOR OR . . .
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# ONE wide-range "OXWELD" W-45 BLOWPIPE

Trade-Mark

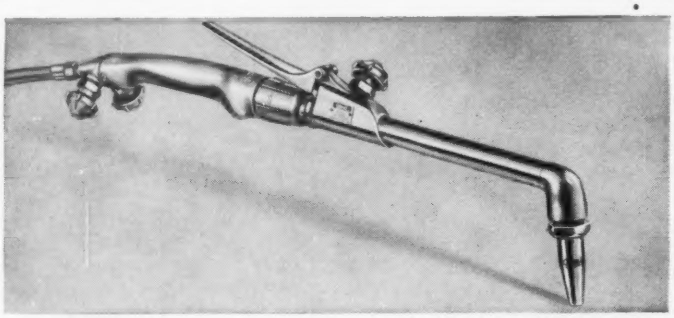
# handles EVERY welding and heating job

*NO OTHER SINGLE BLOWPIPE OFFERS THIS* ***EXTENSIVE RANGE!***


Anyone whose daily work includes welding and heating will readily appreciate the amazing wide range and versatility of the new OXWELD W-45 Blowpipe. Its 18 head sizes (2 to 300 cu. ft. per hr. capacity) provide a perfect flame for every metal thickness. Light sheet to heavy plate, *one blowpipe does it all!*

From chrome-plated tip to offset hose connections, the W-45 shows the results of over a decade of development work by LINDE engineers. Its exclusive "jiffy-lock" heads, "form-fit" handle, and advanced styling are as modern as guided missiles and atomic power. "O" ring gas seals, flame-stabilizing mixers of improved type, and many other innovations put this blowpipe far ahead of the field in economy, ease of operation, and low-cost maintenance.

See for yourself how you can enjoy tomorrow's operating standards today with an OXWELD W-45 Blowpipe. Ask your LINDE representative for a demonstration, or write for free booklet, F-8684.



*CW-45 Cutting Attachment adapts the W-45 Blowpipe for cutting steel up to 8 inches thick.*

**Linde Air Products Company**

**A Division of Union Carbide and Carbon Corporation**

30 East 42nd Street UCC New York 17, N.Y.

Offices in Other Principal Cities

In Canada: LINDE AIR PRODUCTS COMPANY
Division of Union Carbide Canada Limited, Toronto
(formerly Dominion Oxygen Company)

Linde
Trade-Mark

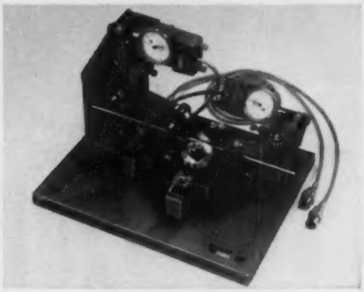




For more information on products advertised, use Inquiry Card, page 235

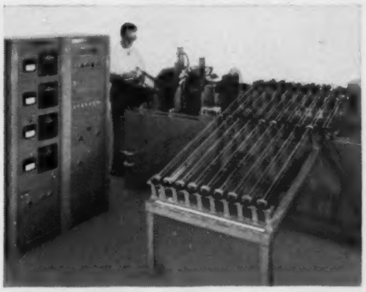
# Ask FEDERAL FOR ANYTHING IN MODERN GAGES

## Automatic Gages



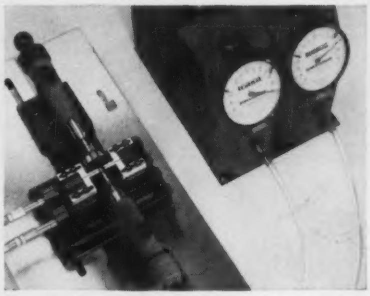
Gage continuously checks width and thickness of square-wire travelling seventy feet a minute.

In-Process Gage measures twenty separate dimensions on thirteen different sizes of fabricated stator blades. Discards off-sizes.

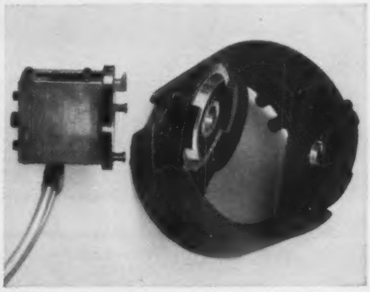


Automatic Sorting Gage sorts valve stems for length, diameter, head thickness, hardness, out-of-round, and taper — at 2400 per hour.

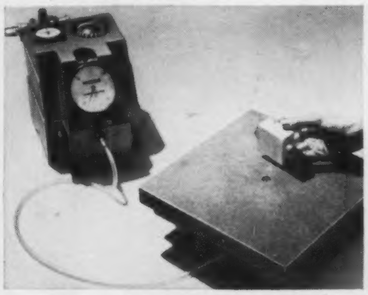
## Air Gages



The amount of taper on a small shaft is determined by two 5,000 to 1 Dimensionairs with AirProbes. Measurements are in increments of .000020".

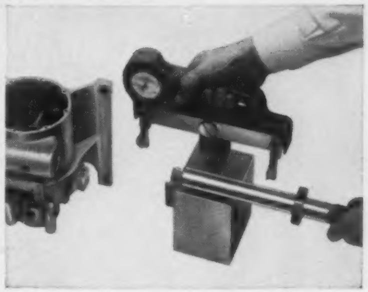


Dimensionair Gage measures a very shallow inside diameter. Frictionless motion-transfer unit contacts AirProbe which takes actual measurement.

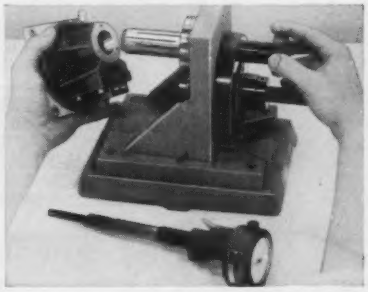


Air-Flatness Gage. AirProbe projects from black granite surface plate. Accurate to .000050" in any 2 x 2 ft. area.

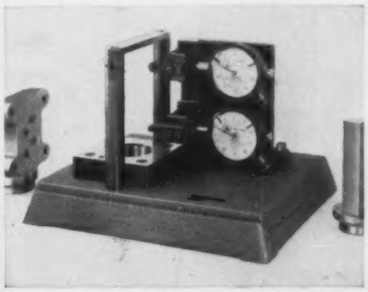
## Mechanical Gages



Indicator Gage checks squareness of horizontal bores in relation to vertical bores. Gage shown is being applied to master.



Parallelism of the two lower holes with the large hole, and with each other, is checked on this specially designed fixture.



Dual-purpose Indicating Gage shows (1) squareness of face with flange and (2) distance from centerline to edge of face. Barrier protects contacts.

Whatever your gaging requirements, it pays to check with Federal.

**RETURN THE COUPON TODAY!**

**Federal Products Corporation**
**Dept. 3C,**
**Providence 1, R. I.**

Please send information:

- ☐ Automatic Gages
- ☐ Air Gages
- ☐ Mechanical Gages

Name ..............................

Company ..............................

Address ..............................

..............................

For more information on products advertised, use Inquiry Card, page 235


*TOCCO heating station with inductor and fixture for silver brazing cylinder and cylinder cap assemblies.*

# with TOCCO* Induction Heating

The experience of The Commercial Shearing and Stamping Company, who use TOCCO for silver-brazing hydraulic cylinder assemblies, is typical of the benefits obtained by America's leading metal-working plants who use TOCCO Induction Heating for brazing, hardening, heat-treating, forging and melting operations.

**More Production with TOCCO**

a. Heating time per piece cut from 15.3 minutes to 2 minutes on 5¼″ I.D. cylinder.

b. Machining and cleaning operations, formerly required, are not needed after TOCCO brazing.

**Lower Costs with TOCCO**

a. Through a reduction in time required for each piece.

b. Through the elimination of scrap and reworks.

c. Because, since TOCCO is automatic, operator need not be trained or especially skilled.

**Improved Product with TOCCO**

a. Because of better looks and sales appeal.

b. Because distortion is minimized.

c. Because of elimination of field failures due to severe stress pockets.

**TOCCO Engineers** — can probably find applications in your plant, too, where TOCCO Induction Heating can increase output, cut unit costs and improve your product. Such a survey costs you nothing—and may save you a great deal.

**THE OHIO CRANKSHAFT COMPANY**

JUST PUSH A BUTTON

**TOCCO**

*Trade Mark Reg. U. S. Pat. Off.

*Mail Coupon Today*

NEW **FREE** BULLETIN

**THE OHIO CRANKSHAFT CO.**
**Dept. M-7, Cleveland 1, Ohio**

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering."

Name__________

Position__________

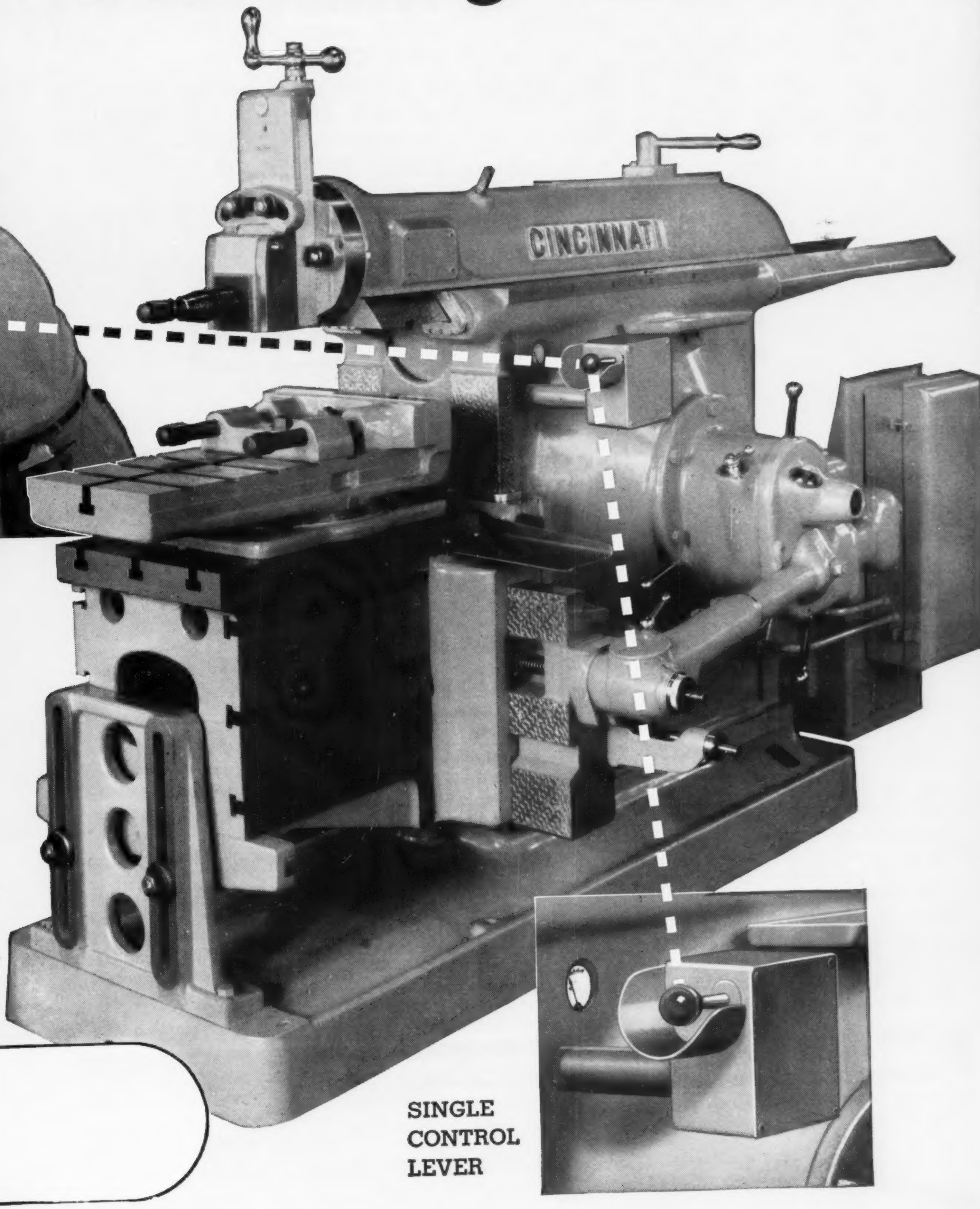
Company__________

Address__________

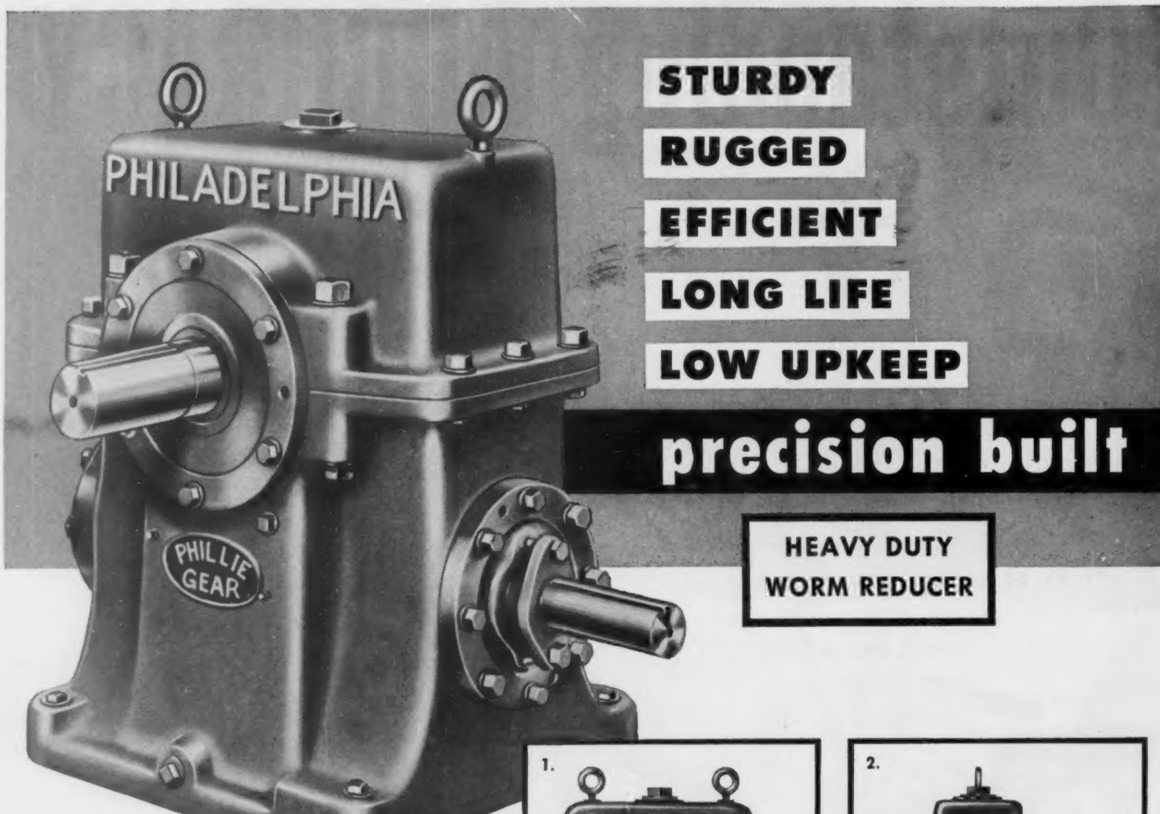
City______ Zone___ State____

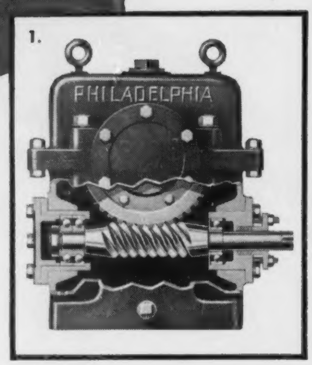
For more information on products advertised, use Inquiry Card, page 235

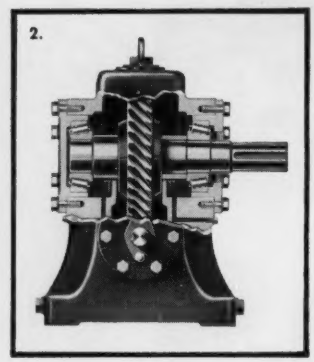
# ...Outstanding ACCURACY




SINGLE
CONTROL
LEVER




1. Heavy Duty, Type "AT" Reducer, showing the rugged worm and shaft construction; generous ball bearing mountings, and the easy-to-get-at, leak-proof stuffing box.

2. Same Reducer, showing section through worm wheel shaft. Note generous spread of roller bearings, and efficient design of oil wells surrounding bearings.

. . . and we really mean "Precision Built,". . . in fact, we have put as much research, design and skill into these heavy duty reducers, as is put into the finest time-pieces or scientific instruments.

In order to assure the user of Long, Efficient Service Life with lowest possible maintenance, materials and manufacturing standards are very rigidly maintained at "Phillie Gear":

**Worms** are of alloy steel with carburized hardened and tempered threads; shafts and threads are precision ground and polished after heat-treating.

**Worm Gears** are made from highest quality chilled-cast nickel bronze.

**Housings** are oil-tight quality grey iron . . . designed to assure maximum rigidity and heat radiation, with ample oil reservoir.

**Units** are available with Worms above or below the Worm Gear; also with shafts up or down for Vertical Drives.

A complete range of sizes is available to cover any application up to 265 H.P., with ratios from 3-5/8:1 to 6300:1. They are built to provide efficient and dependable power transmission under the most rigorous conditions over a long period of time.

For detailed information write for latest catalog WG.

**PHILADELPHIA GEAR WORKS, INC.**

ERIE AVE. & G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
Virginia Gear & Machine Corp. • Lynchburg, Va.

Industrial Gears & Speed Reducers

LimiTorque Valve Controls

Established 1892

# THEY WOULDN'T BELIEVE IT

# —until they SAW it!


Seeing was believing for a group of mechanical officials from one of the mid-west's most prominent earth moving equipment builders.

Frankly they just wouldn't believe that the new 32" "AMERICAN" Pacemaker Lathe would effectively use 60 horse power and cemented carbide cutting tools in machining rough alloy steel forgings. So they came to see for themselves and they saw:

1. Cuts $1\frac{1}{8}''$ deep.
2. Cutting speed 300 feet per minute.
3. .030" feed.
4. 60 to 65 horse power registered by horse power meter during the maximum cuts.
5. Not a shimmy or whimper from the machine.

***They were amazed and convinced.***

This new model Pacemaker is endowed with the power, stamina and convenience that combine to produce a thoroughly dependable and highly productive unit.

Bulletin No. 44 tells all . . . have one?

**THE AMERICAN TOOL WORKS CO.** Cincinnati 2, Ohio, U. S. A.

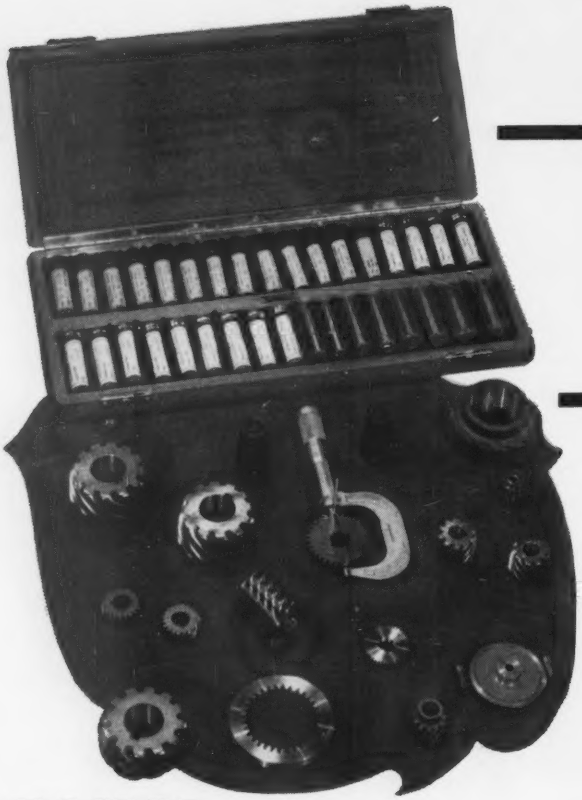
LATHES AND RADIAL DRILLS

For more information on products advertised, use Inquiry Card, page 235

THE

# Van Keuren

# GEAR MEASURING SYSTEM



**Set 26EX—Gear Measuring Wires, accurate to ± .000025", for common diametral pitch external spur gears.**

**VAN KEUREN GEAR MEASURING WIRES PROVIDE THE MOST ACCURATE AND LOW COST METHOD OF MEASURING THE TOOTH THICKNESS OF SPUR AND HELICAL GEARS, INVOLUTE SPLINES AND INVOLUTE SERRATIONS.**

## ONLY . . .
## EQUIPMENT NEEDED:

**1—SET VK MEASURING WIRES**
**1—MEASURING INSTRUMENT**

**Complete information regarding the use of Gear Measuring Wires is contained in a 50-page section of the Van Keuren CATALOG and HANDBOOK No. 35. Included in this section are:**

. . . table of wire sizes for the 1.92", 1.728", 1.68" and 1.44" series.

. . . tables of wire measurement including change factors for standard external and internal spur gears of 14½°, 17½°, 20°, 25°, and 30° pressure angles and of from 5 to 500 teeth.

. . . table of relationships between depth of cut and tooth thickness for common pressure angle gears.

. . . definitions and exact formulas covering involute spur gears.

. . . tables of involute tooth parts for standard addendum and stub tooth involute gears.

. . . information, formulas and examples regarding the wire measurement of helical gears.

. . . information and examples concerning the wire measurement of enlarged pinions and reduced gears.

. . . tables of wire measurement for involute splines.

. . . tables of wire measurement for involute serrations.

. . . tables of comparative measurement over three sizes of wires for use in involute profile checking.

CATALOG and HANDBOOK No. 35 is available without charge by writing to: The Van Keuren Co., 178 Waltham St., Watertown, Mass. Ask for your copy.

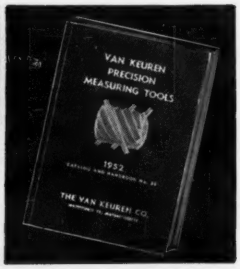
VK

36th Year

THE Van Keuren CO.,

**178 WALTHAM STREET, WATERTOWN, MASS.**

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages



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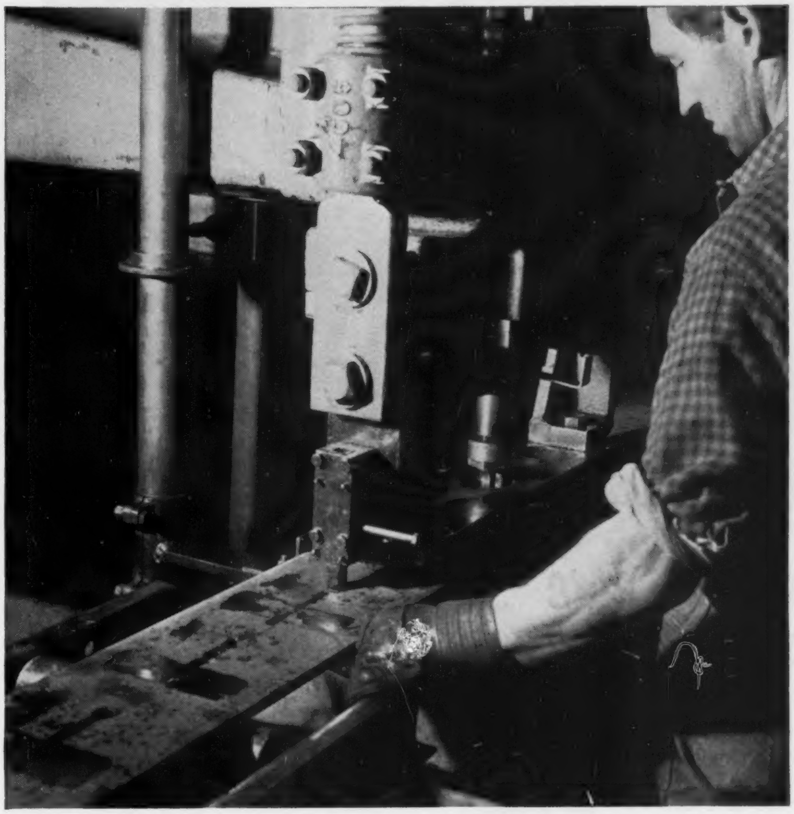
# Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

This Bearcat punch (shown above man's wrist) punches 15 square holes in each ½-in. steel plate, used as cutting edge of snow plows. Average life of punch is 5500 holes, with only three light redressings.

## See What They Gained by Switching to Bearcat!

One of the operations performed in the shops of Frink Sno-Plows, Inc., Clayton, N. Y., is punching 15 holes, 11/16 in. square, in a carbon-steel plate. The plate, ½-in. thick, is used as the cutting edge of highway snow plows. With grades of steel previously used in this punching operation, the service life of each punch varied considerably—anywhere from 300 to 1500 holes.

We felt confident that Bearcat tool steel could do better, and they agreed to give it a trial.

So Bearcat was put to work, with the punch hardened to Rockwell C56-57. Production went up immediately. Now the life of each punch is approximately 5500 holes, with only light redressing of the corners required every 1500 holes or so.

Bearcat is a tough, general-purpose air-hardening tool steel. When used in punches, its chief advantages are exceptional resistance to shock, and superior resistance to wear. Besides, Bearcat's air-hardening characteristic minimizes quenching hazards, and provides good resistance to distortion in heat-treatment.

In addition to punches, there are many other applications where Bearcat can be used to advantage: rivet sets, for example, and chisels, gripper dies, hot headers, master hobs and die-casting die inserts, to name only a few.

Why not learn for yourself how good a tool steel Bearcat really is! You can order it right now through your Bethlehem tool steel distributor. It can also be obtained from our well-stocked mill depot.

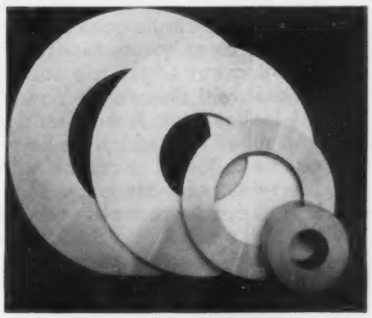
## BETHLEHEM TOOL STEEL ENGINEER SAYS:

### *Switching Grades Won't Cure Tool Troubles*

Granted that quality is of primary importance in tool steel. But there are four other factors which are also essential to the satisfactory performance of tools: (1) good design, (2) correct heat-treatment, (3) proper grinding, and (4) proper application and mechanical use of the tool.

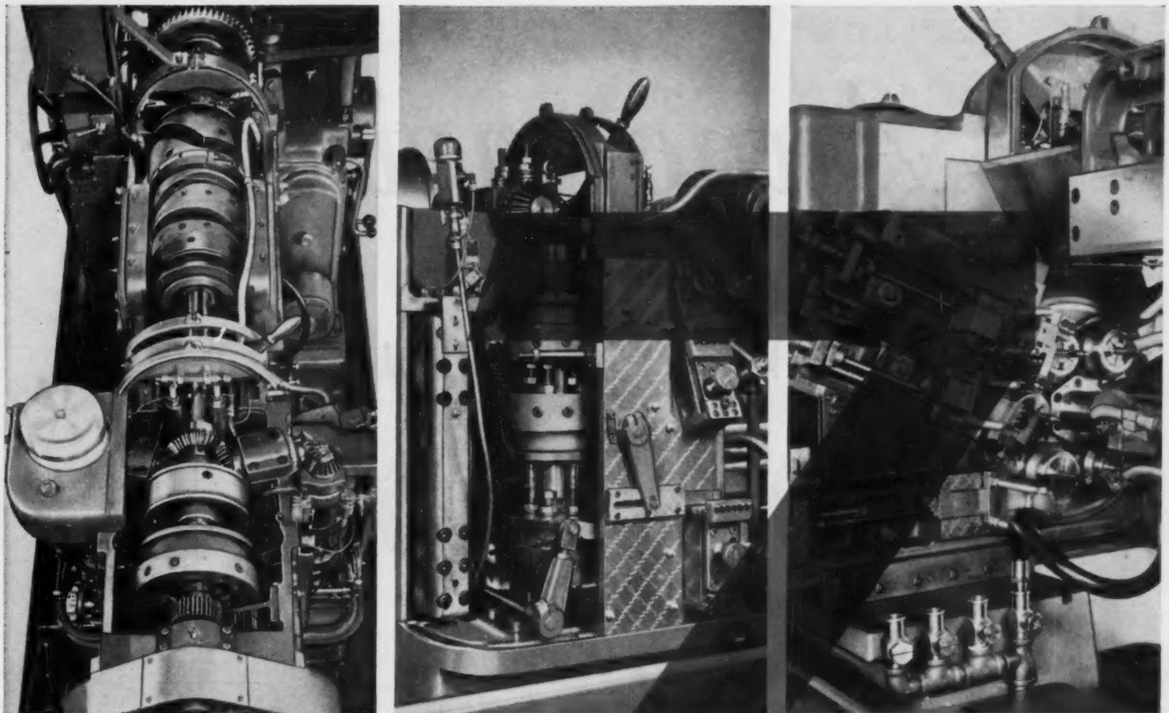
Ordinarily a manufacturer's responsibility lies only in quality. Yet if results are unsatisfactory the user often concludes that "the steel is no good," whereas any of the other factors mentioned may be the real culprit. That is why it is so important to investigate all five of these factors. For they are like links in a chain; unless they are in reasonably good balance, trouble can be expected. When this happens, the tool and its work must be investigated thoroughly before a remedy can be suggested.

In the majority of cases, switching grades is not the answer in attempts to cure trouble with tools, for the difficulty usually lies elsewhere. Before switching grades, the user should first have a clear-cut reason for doing so, and definite objective. Otherwise, the original trouble may be intensified, rather than removed.



## BETHLEHEM HOLLOW-BAR SAVES TIME IN RING-TYPE APPLICATIONS

If you work with ring dies, draw rings, or hardened bushings, you can save time by using Bethlehem Hollow-Bar Tool Steel, either in BTR (oil-hardening) or Lehigh H (high-carbon, high-chrome). Hollow-Bar is made by high-speed trepanning. By this process, hammer-forged or hot-rolled bars are cored out, and are then rough-turned on the outside. With Hollow-Bar, there's no need to wait for forged rings or discs.

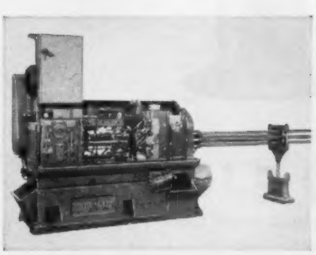


# Seven Fast Changeover Models

With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the $\frac{9}{16}$", 1", $1\frac{5}{8}$" Sixes, and the $2\frac{5}{8}$", $3\frac{1}{2}$", 5", and $5\frac{1}{4}$" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



THE MACHINE TOOL SHOW
CHICAGO, ILL.
MT
BOOTH 40

# Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

For more information on products advertised, use Inquiry Card, page 235

# Farval helps keep walking dragline working —no lost time for lubrication

FARVAL—
*Studies in Centralized Lubrication*
No. 168

LUBRICATION requirements of this giant walking dragline are as complex as the machine itself. It was a tough problem to solve, but a planned Farval Centralized Lubrication System did it. Now, Farval helps keep the dragline working uninterruptedly with minimum time for lubrication.

The entire walking machinery needs a fresh supply of lubricant about every five steps—length of each step is 6 feet 2 inches. Hoisting, dragging and swinging machinery require lubricant on an 8-hour basis. 108 rollers in a roller circle that supports and permits rotation of the control house, require lubrication once every 24 hours. All told, 206 bearings require regular lubrication.

These varying lubrication frequencies are all handled efficiently and surely by one Farval automatic system divided into branches. Any part of the machinery can be lubricated independently of the others.

If you have an equipment lubrication problem, simple or complex, it will pay you to find out how a Farval Centralized Lubrication System can save you time, money and lubricant. Farval delivers oil or grease unfailingly, in the exact amount required when needed, to each bearing served. It can be installed on new or old equipment, often pays for itself in a few weeks or months. Thousands of Farval installations are improving lubrication and operations in practically all industries. Find out how Farval can help *you.* Write for technical advice and ask for Bulletin 26. The Farval Corporation, 3276 East 80th Street, Cleveland 4, Ohio.

*Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.*

Farval-lubricated walking dragline, one of the largest standard production machines of its kind in the world, serving at a Texas mine.

**KEYS TO ADEQUATE LUBRICATION**—Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

FARVAL
CENTRALIZED SYSTEMS OF LUBRICATION

For more information on products advertised, use Inquiry Card, page 235

For more information on products advertised, use Inquiry Card, page 235

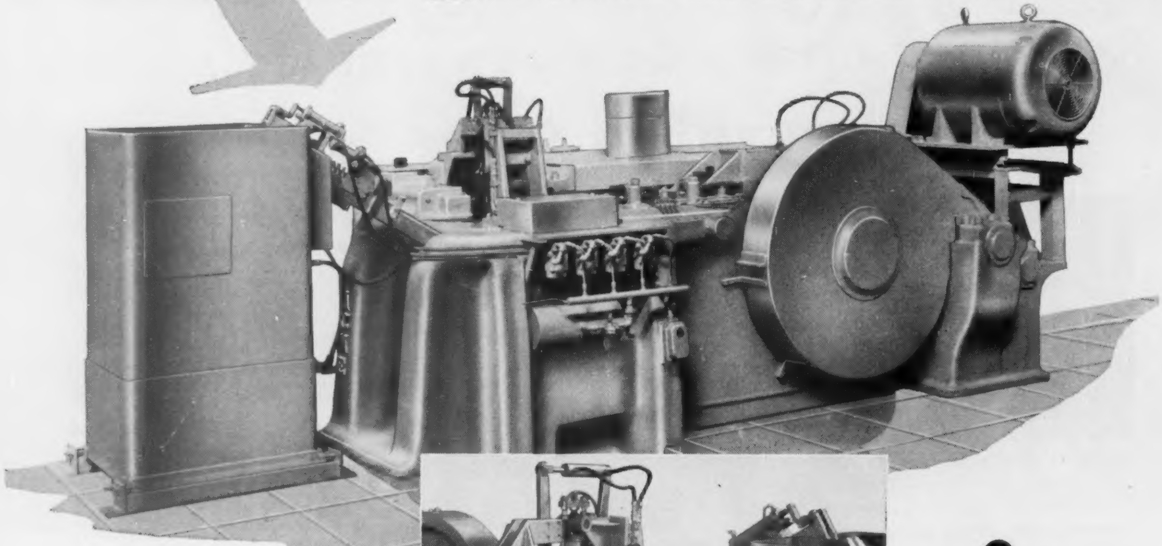
# *ACME MODEL XN*

## *produces 2,400 completed forgings per hour!*

A standard 3" ACME XN forging machine is producing, in multiple operations, a completed forging with every stroke of the machine in the plant of a large automotive manufacturer. Continuous operation with an automatic feeding device makes this amazing production possible.

### *PHENOMINAL SAVINGS*

The increase in output through continuous operation of this ACME XN forging machine results in savings which are not only impressive but approach the incredible. The ACME XN with automatic feed is adaptable to either single or multiple operation forging. Every job, of necessity, calls for special design in the feed mechanism depending upon the shape, size and weight of the material involved. ACME XN forging machines are made in capacities from 1" to 5". We would like to discuss YOUR forging problems at your convenience.



***Seventy-five Years of Continuous Forging Development***

HILL ACME TOOLS FOR INDUSTRY

# THE HILL ACME COMPANY

**ACME MACHINERY DIVISION • 1209 W. 65th St., Cleveland 2, Ohio**
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

YOU CAN'T BUILD

# TOMORROW'S PROFITS WITH YESTERDAY'S MACHINES

*Modernize* **NOW** *with* P&J

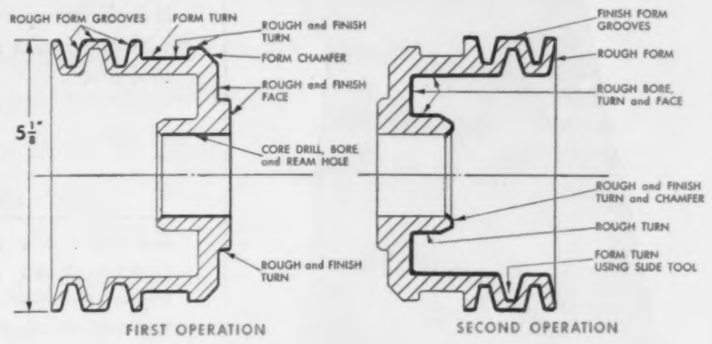
## JOB FACTS:

**PART** . . . . Pulley

**SIZE** . . . . . Approx. 3¾" long x 5¼" Diam. (Rough Casting)

**MATERIAL** . . Cast Iron

**OPERATIONS** All surfaces rough and finish machined. Hole reamed. Twenty-five separate cuts in all.




SURFACES MACHINED ARE INDICATED BY HEAVY LINES

A very real problem that faced a large engine manufacturer was solved by installing MODERN EQUIPMENT. A Potter & Johnston Automatic provided the speed, power and versatility to meet their demands for fast, accurate, low-cost production. Tooling engineered by P&J Specialists took full advantage of combined cuts and faster-cutting carbide tools to reduce machining time to a minimum.

No, you can't handle today's . . . and tomorrow's . . . job requirements on yesterday's machines. Give yourself an extra margin of profit; modernize with Potter & Johnston Automatics . . . and with P&J Tooling. Start today . . . SEND FOR YOUR COPY OF BULLETIN NO. 154 — "34 Practical Production Ideas."

MODERNIZE with POTTER & JOHNSTON REPLACE FOR PROFIT

LET P & J SHOW *You* THE WAY


. . . SEE US AT BOOTH 1219

**POTTER & JOHNSTON CO.**
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
**PRATT & WHITNEY**
DIVISION NILES-BEMENT-POND COMPANY

PRECISION PRODUCTION TOOLING P&J FOR MORE THAN FIFTY YEARS

# ERCO's NEW SHRINKER & STRETCHER . . .

## MODEL #187

## . . . provides 50% greater capacity!

Soon available for delivery, ERCO's new foot-operated Shrinker & Stretcher is a great improvement over earlier ERCO models. This machine has 50% greater capacity . . . is easier to operate . . . handles all material thicknesses with maximum mechanical advantage . . . lengthens tool life.

**CAPACITIES**

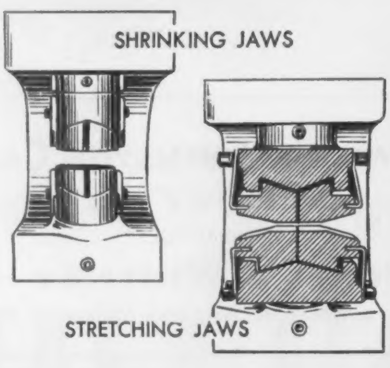
| MATERIAL | THICKNESS | STRIP WIDTH |
|---|---|---|
| Mild Steel . . . . . . . . . . . . . | 3/16" | 1½" |
| 24S-T6 Aluminum . . . . . . . . . . | 5/32" | 1½" |
| Stainless Steel (100,000 psi) . . . . . | .125 | 1" |
| Titanium (100,000 psi) . . . . . . . . | .109 | 1" |

**WHAT DOES ERCO's SHRINKER & STRETCHER DO?**
It decreases or increases the length of metals in localized areas and obtains results impossible with other metal working tools. This foot-operated model, requiring little floor space, is used for:

*a. forming contours on angles and flat strips without using presses and expensive dies for small runs;*

*b. straightening warped angles and flats;*

*c. removing flange wrinkles and warpage from pressformed parts.*




The new style shrinking and stretching jaws perfected by ERCO offer you important advantages:

Greater work area . . . less work marking . . . automatic adjustment to the shrinking action.

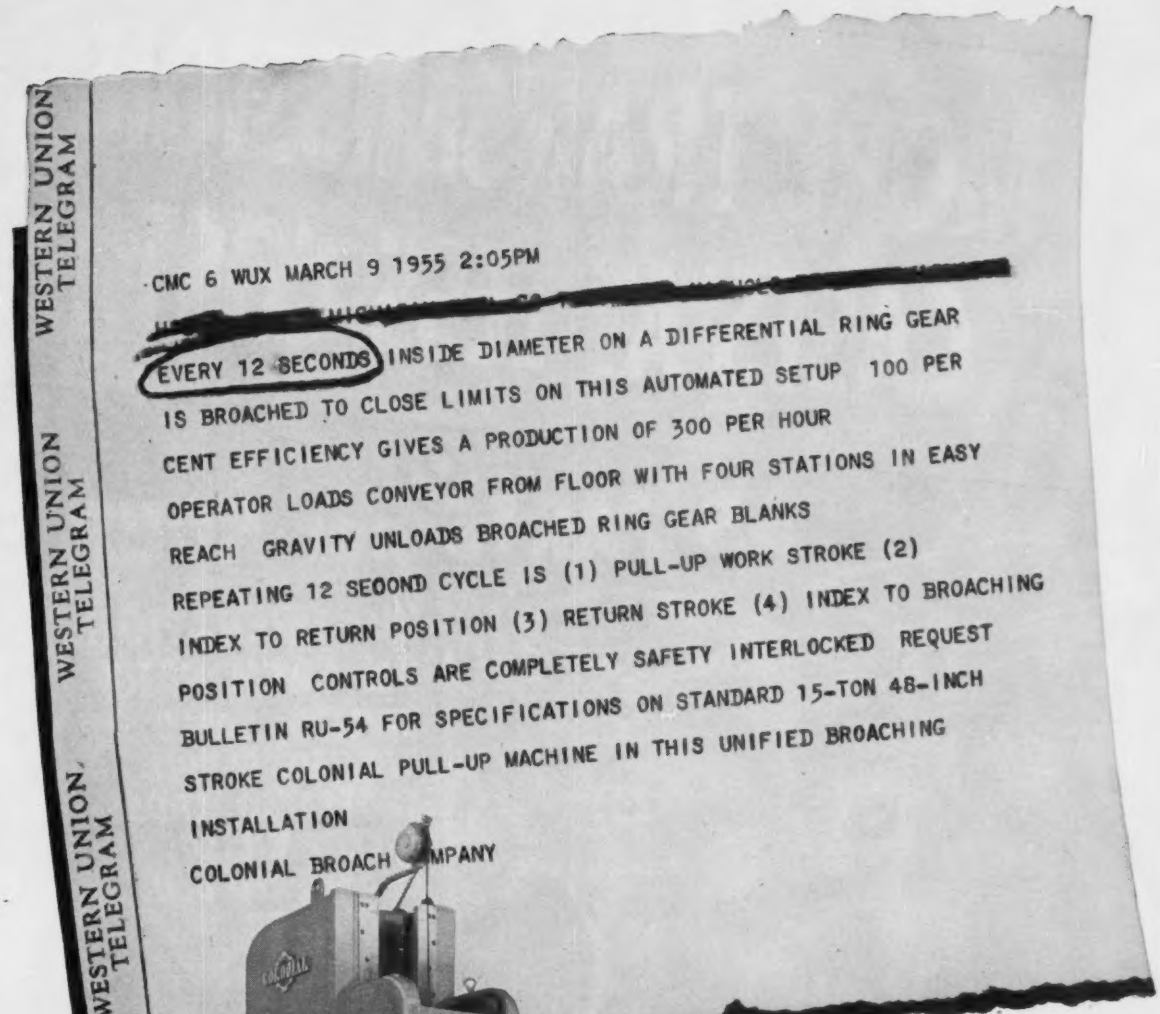
***In brief: more capacity, less effort!***

*For complete information, write:*

**ENGINEERING and RESEARCH**

A DIVISION OF acf INDUSTRIES INCORPORATED

RIVERDALE, MARYLAND




# every 12 seconds!

PIONEERS OF H.S.S. BROACHING
COLONIAL
BROACH CO. DETROIT 13

*UNIFIED BROACHING is the key to successful broaching*

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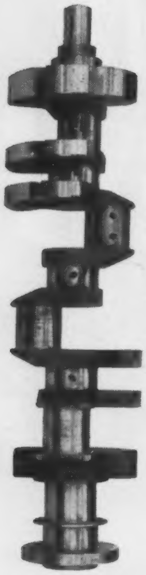
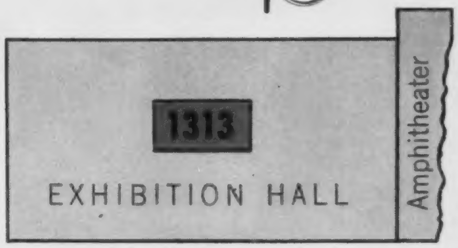


what can you do when you face


LeBLOND
of Cincinnati
New 13" Regal
New 16" Apron
New 15" Dual Drive
50" Roll Turning Lathe
New 32" Spindle
LeBLOND
New Heavy Duty Bed
New Heavy Duty Tailstock
New 32" Heavy Duty

# AT THE SHOW

We are extremely proud of the major design advancements you'll see at the LeBlond Exhibit—No. 1313, dead center in the new Exhibition Hall. You'll see 16 of the world's most modern lathes. You'll witness unique demonstrations in tracing, rapid boring and high-power turning. *Don't miss LeBlond!*




**NEW 13", 15", 17" and 19" Regal Lathes**

Famous for dependable performance at low cost, our Regals have been redesigned from the ground up! Big-lathe features include — Combined gear and belt-drive headstock. Replaceable hardened steel bedways. Separate feedrod and leadscrew.

**NEW 15" Dual Drive Lathe**

Best buy in the medium-duty class, the new Dual Drive features 16 speeds from 30 to 2400 rpm through a combined gear and belt-drive headstock. 5 hp. Replaceable hardened steel bedways. Totally-enclosed quick change box.

**NEW 16" Heavy Duty Lathe**

Most popular of the heavy duties, our new 16" provides 27 speeds from 16 to 2000 rpm through a combined gear and belt-drive headstock. 20 hp. Four way power rapid traverse. Replaceable hardened steel bedways. Enclosed quick change box.

**RT Toolroom Lathe**

Even today, other lathes can't match the advanced designs pioneered by LeBlond in the RT. Universal QC box—90 feeds and threads. Automatic chasing stop. Combined feed apron with built-in taper attachment.

**NEW 25" and 32" Heavy-Duty Lathes**

Cut with confidence at high horsepower! New headstocks use heavy, short shafts; 4-bearing spindle; provide adjustable accelerations for starting, stopping, jogging. 50 hp on the 25", 60 hp on the 32".

**NEW 32" Special Heavy-Duty Lathe**

You'll see well over 100 hp actually used at the tool. Built for Carboloy to test the newest in carbide tooling, this special 32" uses a 125 hp, variable speed drive, provides speeds from 42 to 1400 rpm.

**NEW 25"/50" Sliding Bed Gap Lathe**

A brand new model of this most versatile of lathe designs. Headstock provides 36 spindle speeds from 6 to 625 rpm. Adjustable acceleration for starting, stopping, jogging. New bed increases stability, easy cleanout.

**50" Roll Turning Lathe**

See how huge steel mill rolls are contoured in less than half former time. Two-directional hydraulic tracing from a simple template. Feed and speed can be varied during cut without leaving a tool mark.

**NEW Automatic Crankshaft Lathe**

Fifty-five crankshafts per hour are turned on the fastest crank-turning equipment yet developed. Five main bearings, flange and pilot, sprocket diameter and front end turned simultaneously. Transfer is automatic.

**NEW LeBlond-Carlstedt Rapid Borer**

Entirely new concept in high production of deep holes. Designed expressly to accommodate the new boring method and tooling developed in Europe. Don't miss this demonstration — *see holes bored 3 to 8 times faster than ever before!*

***... cut with confidence***

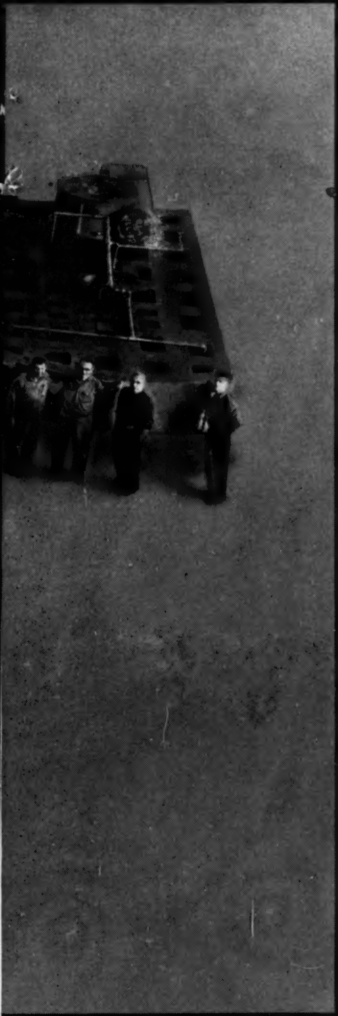
LeBLOND of Cincinnati

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

*World's Largest Builder of a Complete Line of Lathes . . . For More than 68 Years*

For more information on products advertised, use Inquiry Card, page 235

# Build Them BIGGER!



Mill

**The size of the equipment in your own shop need no longer limit the size of the products you build.**

Consolidated is completing a two million dollar shop expansion program that will make some of the world's largest machine tools available to you for your own big work.

This program includes a Betts 42-foot Vertical Boring and Turning Mill, a Betts 96-inch Lathe with 50 feet between centers, a Sellers 10-inch Floor Type Horizontal Boring and Milling Machine with 12 feet of head travel on the column and 25 feet of column travel on the runway. The two new cranes in this big shop have a combined lifting capacity of 150 tons.

This equipment with Consolidated's other big tools and skilled workmen are available to you. You can now build your own products larger and we will help you do it.

COMPANY, ROCHESTER 10, N. Y.

BIRMINGHAM CO., INC.

# BUILT-IN PRECISION

## FOR INSPECTION

*Circular Spacing and Angular Positioning*

PRECISION

# ROTARY TABLES

VERTICAL

**Here is a Sound Investment That Pays Off in . . .**

- **EXTREME ACCURACY . . .**
  P&W Rotary Tables index to any angle in 360° within seconds of arc. Ideal for precision inspection and circular indexing.

- **GREATER ECONOMY . . .**
  by eliminating expensive machining fixtures and time-consuming set ups. Complicated inspection operations are performed dependably and rapidly.

- **LONGER LIFE . . .**
  Built for ruggedness and stamina as well as accuracy, P&W Rotary Tables give continuous dependable service year after year.

- **EXTRA SPEED . . .**
  Compound angle settings with Tilting Tables are quickly accomplished by tilting the table to the required angle and then rotating. Jobs ordinarily difficult and time-consuming become fast and simple. Motor-driven models handle heavy work easily, conveniently.

**PRATT & WHITNEY**

DIVISION NILES-BEMENT-POND COMPANY

**WEST HARTFORD 1, CONNECTICUT, U.S.A.**

BRANCH OFFICES . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., W. HARTFORD

**PRATT & WHITNEY**

DIVISION NILES-BEMENT-POND CO.

**12 Charter Oak Blvd., West Hartford, Conn.**

*Please send my copy of P&W Rotary Table Circular No. 558.*

NAME__________

POSITION__________

COMPANY__________

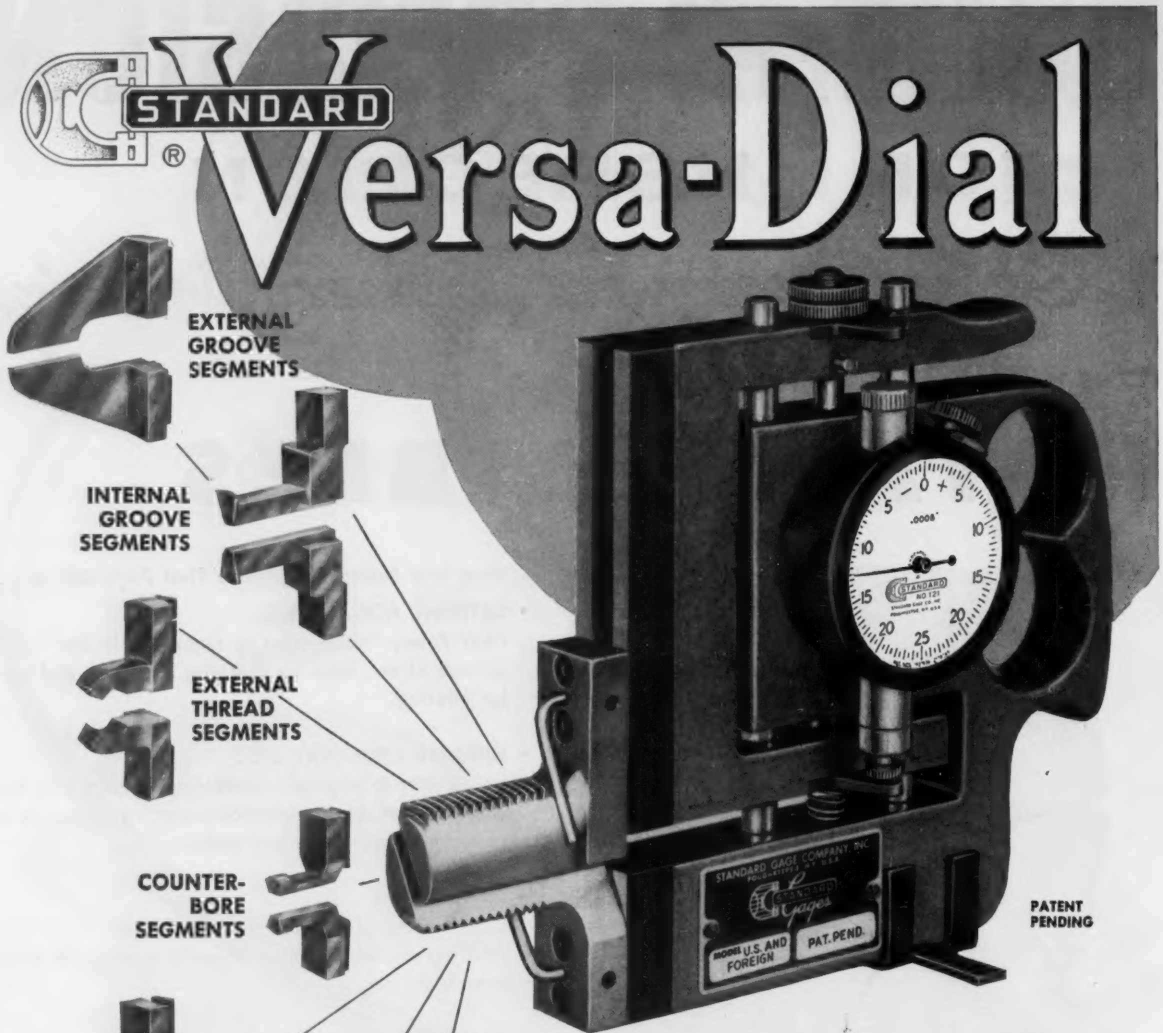
CO. ADDRESS__________

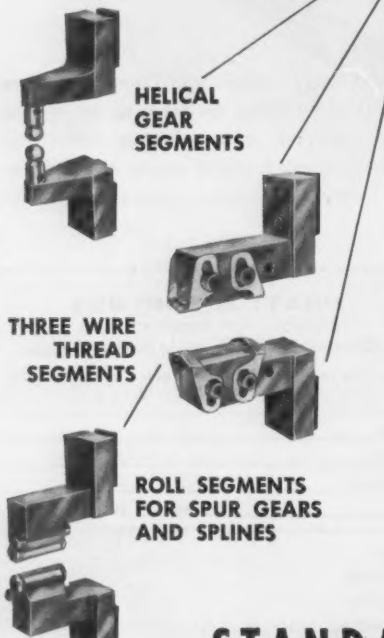
CITY__________ZONE_____STATE__________

FIRST CHOICE FOR ACCURACY · MACHINE TOOLS • CUTTING TOOLS • GAGES

SINCE 1860

For more information on products advertised, use Inquiry Card, page 235




## *The* **ONE** *truly* **ALL-PURPOSE** *Dial Gage*

One compact, lightweight, easily handled dial unit and readily interchangeable segments. *Every assembly is as efficient and accurate as though specifically built for each individual application.* Versa-Dial checks internal or external threads for fit, pitch diameter or lead; helical or spur gears for pitch diameter or tooth spacing; grooves, shallow counterbores, narrow shoulders, blind holes, etc. . . . practically all types of internal and external applications. No other dial gage serves so many purposes so well . . . at bench or machine.

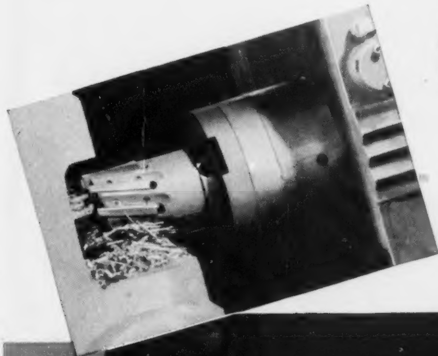
***Send for Special Brochure***

**STANDARD GAGE COMPANY, INC.**
**22 PARKER AVENUE • POUGHKEEPSIE, N. Y.**

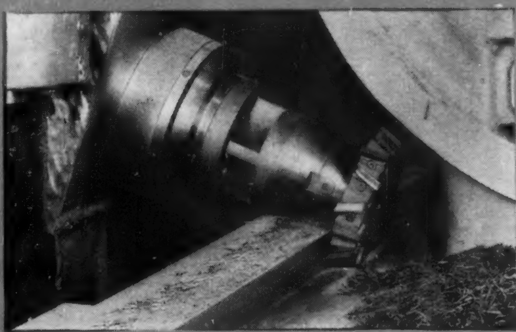


For more information on products advertised, use Inquiry Card, page 235

# INGERSOLL INSERTED BLADE CUTTERS

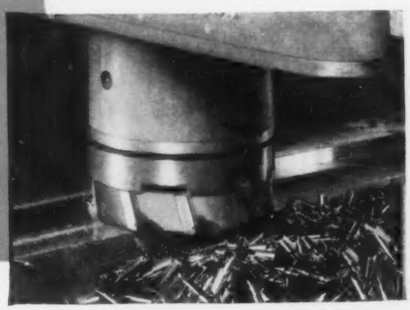


## *First* IN PERFORMANCE AND ECONOMY . . .



THE FIRST CHOICE of leading shops across the country, Ingersoll milling and boring cutters give higher feeds, longer tool life, and increased production.

Shop men have confidence in cutters built by Ingersoll, a company with 65 years of experience in producing special machines and cutters to meet many kinds of production needs. The economy of using inserted blades instead of replacing the entire cutter is another reason for the popularity of Ingersoll cutting tools.



**INGERSOLL PRODUCES A COMPLETE LINE** of standard cutters in a wide variety of styles and sizes. Special cutting tools are individually designed for unusual cutting problems.

WRITE FOR CATALOG 60B, **describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters, and boring heads.**


THE INGERSOLL

MILLING MACHINE COMPANY

ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES

ORIGINATORS OF SHEAR CLEAR CUTTERS

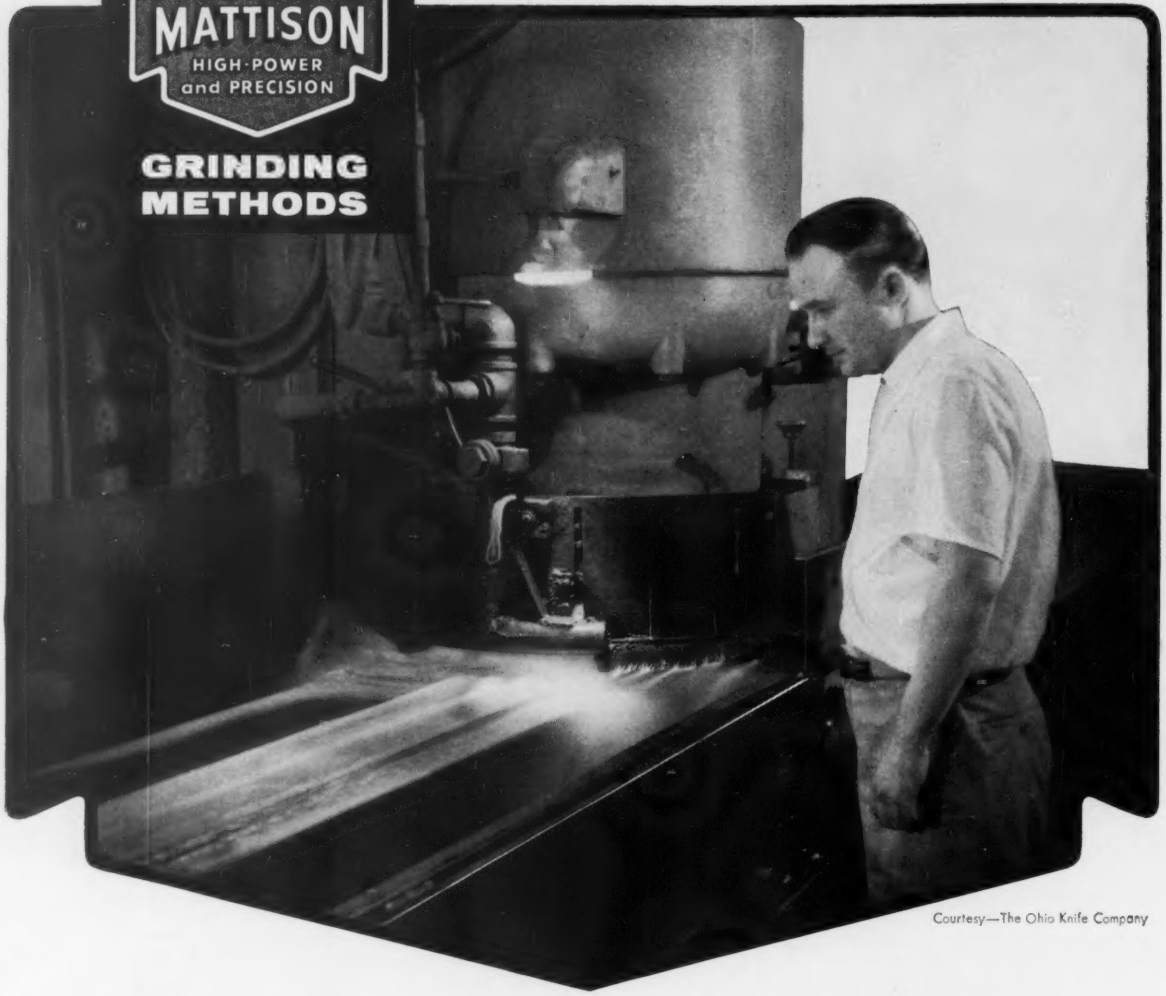


FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 5—H-S STEEL SHEAR BLADES

MATTISON
HIGH-POWER
and PRECISION

**GRINDING METHODS**



Courtesy—The Ohio Knife Company

## Holds .001″ tolerance over 123″ length . . .
## facing high-speed steel shear blades!

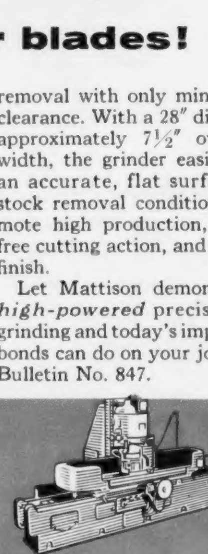
Operation—face two sides and race one edge of No. 4 welded high-speed steel shear blades (123″ x 2⅞″). Accuracy is within .001″.

Two sides of shear blades are ground on the Mattison No. 400SS Vertical Spindle Surface Grinder, holding a tolerance of .001″ over entire length. Such accuracy is easily achieved on the "400SS" because the hydraulic table, heavily ribbed in *two* directions, never overhangs the bed, even at extreme end positions.

Stock removal and flatness are no problem, either. For, Mattison's extra long and heavy head slide prevents twist and deflection—high horsepower permits maximum stock removal with only minimum wheel clearance. With a 28″ dia. wheel and approximately $7\frac{1}{2}$″ over-all work width, the grinder easily generates an accurate, flat surface . . . with stock removal conditions that promote high production, maintain a free cutting action, and produce fine finish.

Let Mattison demonstrate what *high-powered* precision surface grinding and today's improved wheel bonds can do on your job. Write for Bulletin No. 847.

**IF IT'S A FLAT SURFACE**
**THERE IS A MATTISON**
**TO GRIND IT**

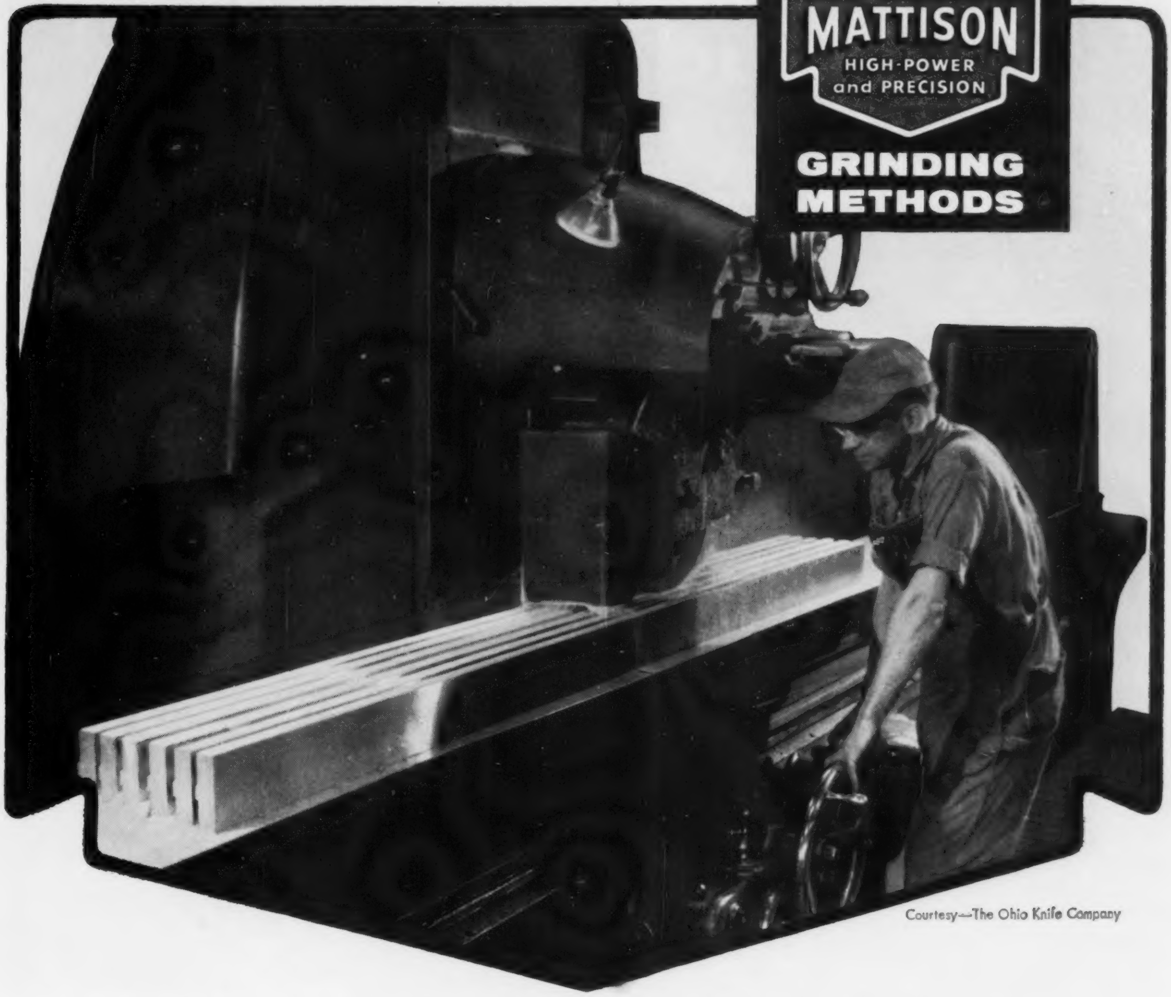




CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 6—HARDENED WAYS

**MATTISON**
HIGH-POWER and PRECISION
**GRINDING METHODS**



Courtesy—The Ohio Knife Company

## Grinds extra-fine finish on hardened ways

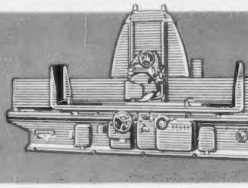
## . . . holds ±.0002″ tolerance!

Fine micro finish is produced on these hardened machine ways, and accuracy is held to ± .0002″, *or better*, finish grinding on the Mattison High-Powered Precision Surface Grinder. Ways are SAE 52100, hardened to 64-66 Rockwell, C scale, and measure 107″ x 4-½″ x 1-15/16″. They are ground at profit-boosting speed . . . several pieces per load.

Manufacturers specializing in precision-ground machine parts use Mattison High-Powered Precision Grinders as a *production* tool.

"Fussy" toolroom jobs are processed at surprising speed because Mattison's double-column design and extra-heavy construction provides tremendous rigidity! Try this versatile and cost-cutting machine for flat grinding large work or multiple small parts . . . contour work requiring a crush- or angle-dressed wheel . . . shoulder and edge work...interrupted surfaces . . . heavy stock removal... and fine finishing. Send your parts to Mattison's Methods Laboratory for sample grind and production estimate.

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.

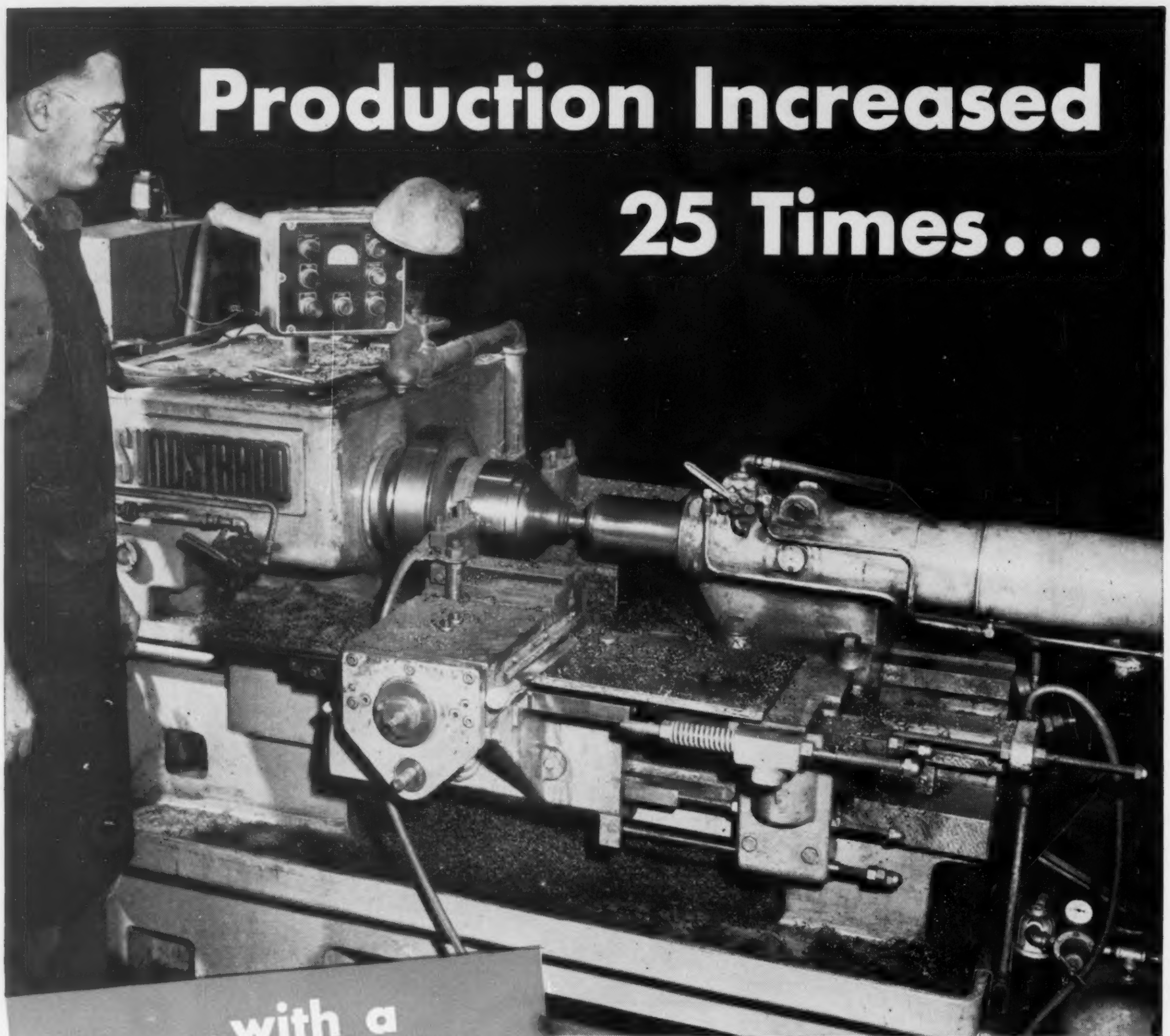


**MATTISON HIGH-POWERED PRECISION SURFACE GRINDERS**

Four of six Mattison Grinders at The Ohio Knife Company, which prides itself on "the best and most modern machine tools."



CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

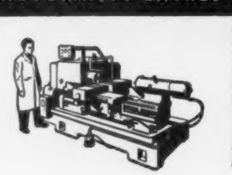



. . . with a
SUNDSTRAND
Automatic Lathe

A. O. Smith Corporation increased production of stator core assemblies over 25 times with the installation of a Sundstrand Model 8A Automatic Lathe. These stator core parts, which are of silicon-iron laminations, have the outside diameter turned and the ends chamfered. With the previous method, tool life was short and the parts required a ruff and finish cut to obtain the desired accuracy and finish. With the Sundstrand Automatic Lathe and tooling method only one cut was necessary to obtain the desired finish and accuracy, while greatly increasing the rate of production.

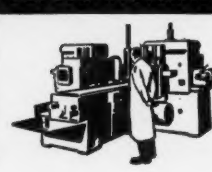
SUNDSTRAND 50 YEARS OF "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES



SIMPLEX RIGIDMILS

DUPLEX RIGIDMILS





CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.


## see how GREENLEE DOES IT!

**VISIT BOOTH No. 1221 AT THE 1955 MACHINE TOOL SHOW**

See this production problem solved on a Special Greenlee Bar Automatic. It will be in normal production operation here at the show.

THE MACHINE TOOL SHOW
CHICAGO, ILL.

## GREENLEE CAN HELP SOLVE YOUR PRODUCTION PROBLEMS

**The creative know-how that built this special auger-bit machine is available to you. Make full use of Greenlee specialized engineering skills and ingenuity. Take advantage of its cost saving possibilities.**

GREENLEE

**GREENLEE BROS. & CO.**
1867 MASON AVE.
Rockford,
Illinois

**write for further information**

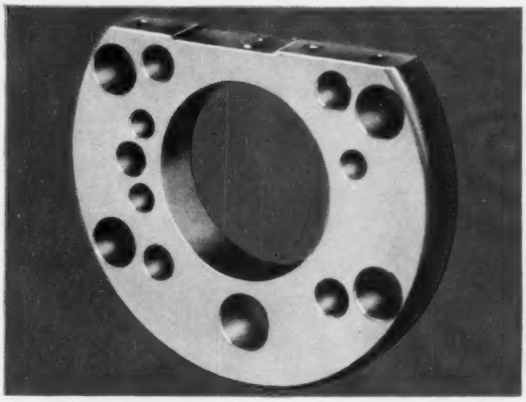


CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

# REHNBERG-JACOBSON

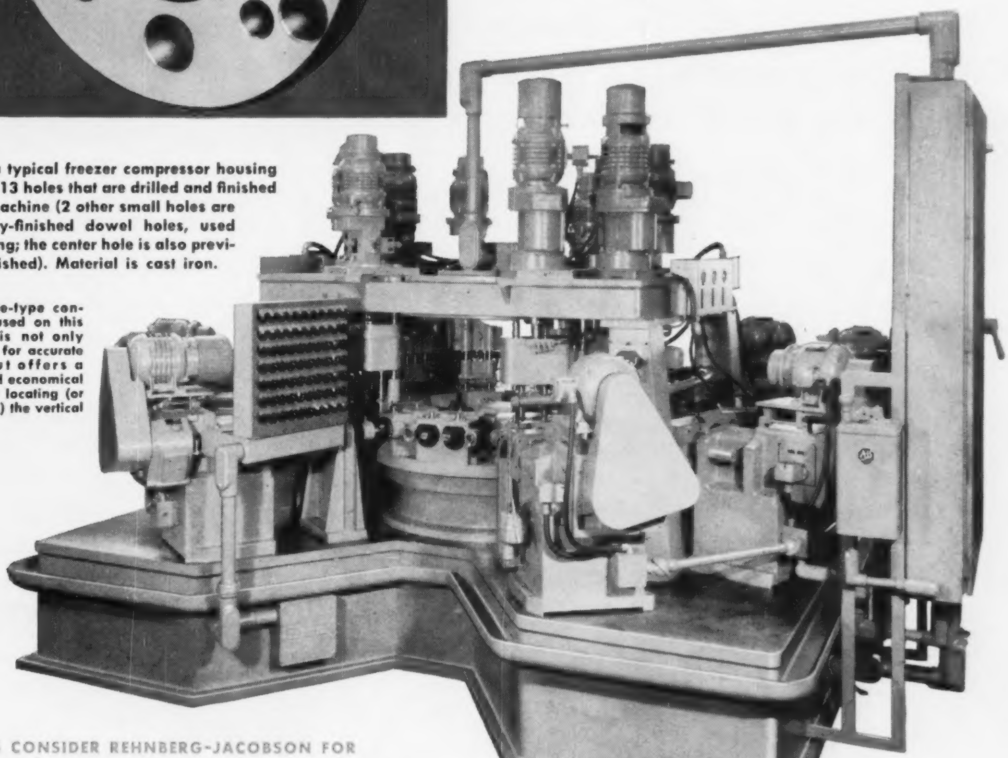
*Shows the way to...*

## DRILL, MILL, COUNTERSINK, AND TAP
# FREEZER COMPRESSOR HOUSINGS



This 10-station BRIDGE TYPE machine has 18 R-J Drill, Tap, and Special Milling Units that work on the piece from vertical as well as horizontal directions. A lot of operations are performed, including drilling to depth, drilling through, countersinking, chamfering, cross milling, hollow milling, and tapping. The pieces go through the machine twice, first in the "A" and then in the "B" positions on the fixtures. The machine handles two sizes of housings, differing in thickness and arrangement of holes, with only a very short time required for changeover. Capacity is 264 pieces per hour.

**Above, a typical freezer compressor housing showing 13 holes that are drilled and finished on this machine (2 other small holes are previously-finished dowel holes, used for locating; the center hole is also previously finished). Material is cast iron.**



**The bridge-type construction used on this machine is not only very rigid for accurate work, but offers a simple and economical means for locating (or re-locating) the vertical Units.**

ALWAYS CONSIDER REHNBERG-JACOBSON FOR
INGENIOUS SOLUTIONS OF YOUR PRODUCTION PROBLEMS

*Designers and Builders of Special Machinery*

R-J

**REHNBERG-JACOBSON MANUFACTURING COMPANY**

**2135 KISHWAUKEE ST.**
**ROCKFORD, ILLINOIS**



**FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.**

# Hendey NO. 2E LATHE WITH ELECTRONIC

*simplifies lathe operation . .*

**OPERATOR EFFORT IS REDUCED TO A MINIMUM**
**MACHINING EFFICIENCY IS INCREASED**
**16-7/16" SWING OVER WAYS**
**COSTS ARE CUT AT EVERY TURN**

Hendey electronic control of spindle speeds on No. 2E Precision Lathes is effortless with this convenient fingertip selector. It affords a quieter, more efficient drive, with closer control over speeds than is possible with other types, especially at the slower rates. Speeds are adjusted smoothly, either pre-set or while cutting, through the full range up to 1500 r.p.m. to give the most efficient cutting rate for the particular type of cut. Operating efficiency is further stepped-up by single-lever control of start, stop and reverse. Dynamic braking allows smooth and rapid changing from forward to reverse rotation of the spindle.

Additional Hendey quality features make this general purpose lathe a machine you should see before you buy any lathe . . . especially if you want maximum operating efficiency, work accuracy and reduced cost on turning operations.

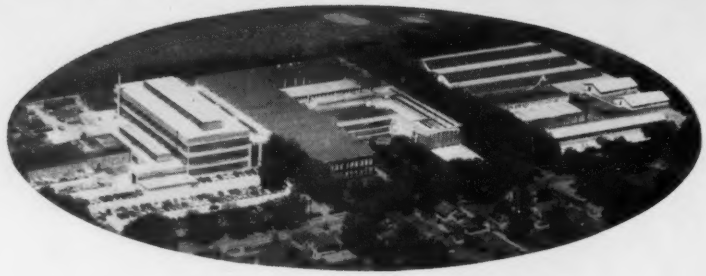
**See It In Action! Booth No. 221**

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

**TOPS IN ACCURACY . . . HENDEY PRECISION-BUILT**



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

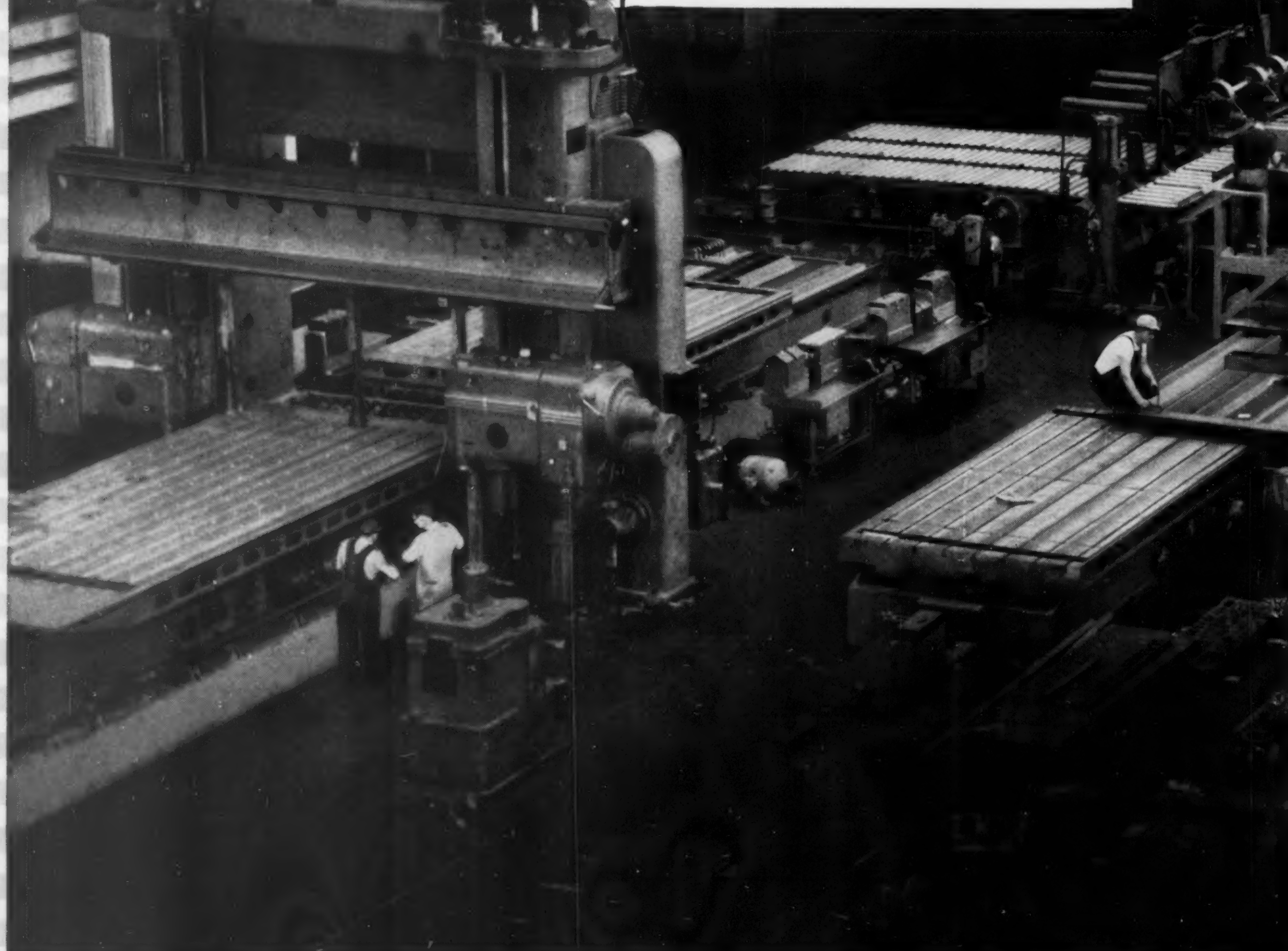


## INVITATION TO VISIT INGERSOLL IN 1955

This is really a moving picture. By the time this invitation reaches you, all of these Ingersoll custom-designed machines will have been shipped.

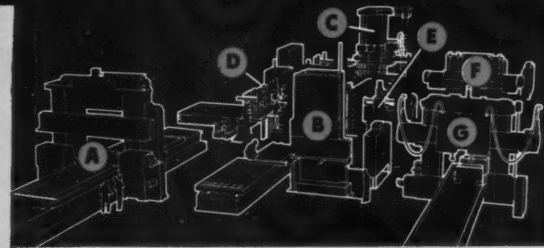
However, a steady flow of other large and interesting machines can be seen on our erecting floors during the weeks and months ahead. We would like to have the opportunity to show them to you. We believe you will also find the production facilities used to build Ingersoll machines of interest. Just let us know when it will be convenient for you to come to Ingersoll.

*(A brief description of the machines that were being erected when this picture was taken is on the right.)*





CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**




## OVER 2,000,000 POUNDS AND 1,500 HORSEPOWER

The seven machines in various stages of assembly on this floor have a combined weight of 2,050,000 pounds and a total connected horsepower of 1,550.

**A** An Ingersoll 150 H.P. Adjustable Rail Milling Machine which will be used to machine forging press parts—diesel engines—rolling mill equipment.

**B** A 133 ton Ingersoll openside machine designed for a wide range of general purpose milling and boring operations.

**C** An Ingersoll 7" bar openside machine for large automobile body die work.

**D** Special design Ingersoll 460 H.P. aluminum scalping machine. (To a large extent hidden by "B")

**E** (Partially hidden) An Ingersoll vertical spindle milling machine specially designed for performing die sinking operations on small automobile dies.

**F** An Ingersoll special design milling machine for milling the flats and performing keyway operations on the necks of rolling mill rolls.

**G** A specially designed 150 H.P. Ingersoll adjustable rail milling machine.

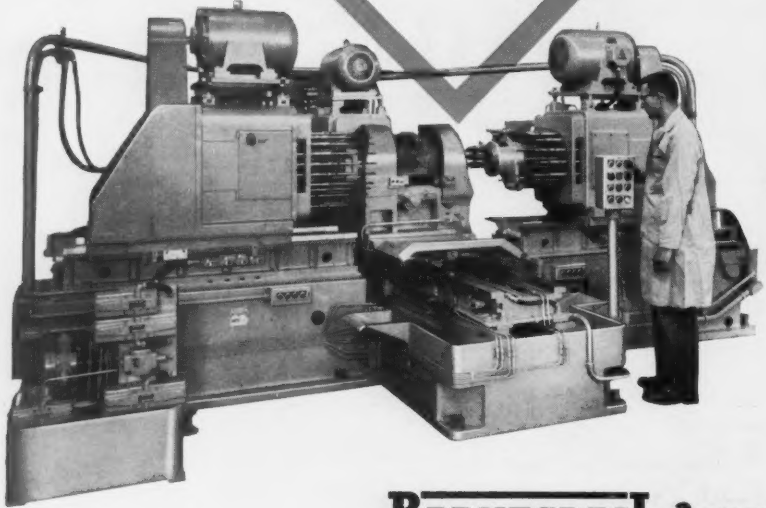

# THE INGERSOLL

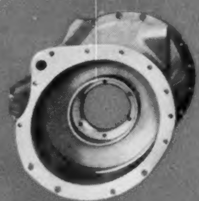
MILLING MACHINE COMPANY • ROCKFORD, ILLINOIS



FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

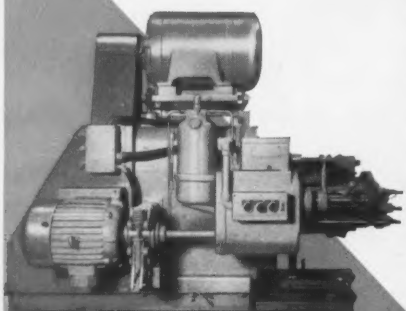
# 65 Holes Drilled and Tapped In **single** Rapid Approach-Feed **cycle**





## BARNESDRIL 3-way, 3-position UNIT MACHINE

### guarantees controlled production rate



View Showing Lead-Screw Tapping Unit Mounted on the Side of Production Drill Unit.

This production-unit combination indicates the versatility of Unit-machining in drilling and tapping. 65 holes are drilled and tapped on 3 different planes — all in the same single rapid approach-feed cyclo.

Two of the three production units grouped around this common base have lead screw tapping units mounted on the same slide. When the cycle starts, the production drill-unit rapid approaches and feeds. The tapping unit simultaneously rapid approaches to a positive stop, and lead-screw taps while the drill feed is operating. At completion of the cut the combined units rapid return for index. The third unit is strictly a drilling unit, and operates in cycle with the other two. Drill spindles are slip-type construction for job-lot flexibility.

Production averages 16 transmission housings per hour at 80% efficiency, and parts are completely drilled and tapped in one single operation.

This is a typical example of applied BarnesdriL engineering experience in combining a wide range of production operations into the shortest possible production time. Drop in at our Booth at the Machine Tool Show and talk over controlled production rates for your shop.

BOOTH NO. 818

THE MACHINE TOOL SHOW

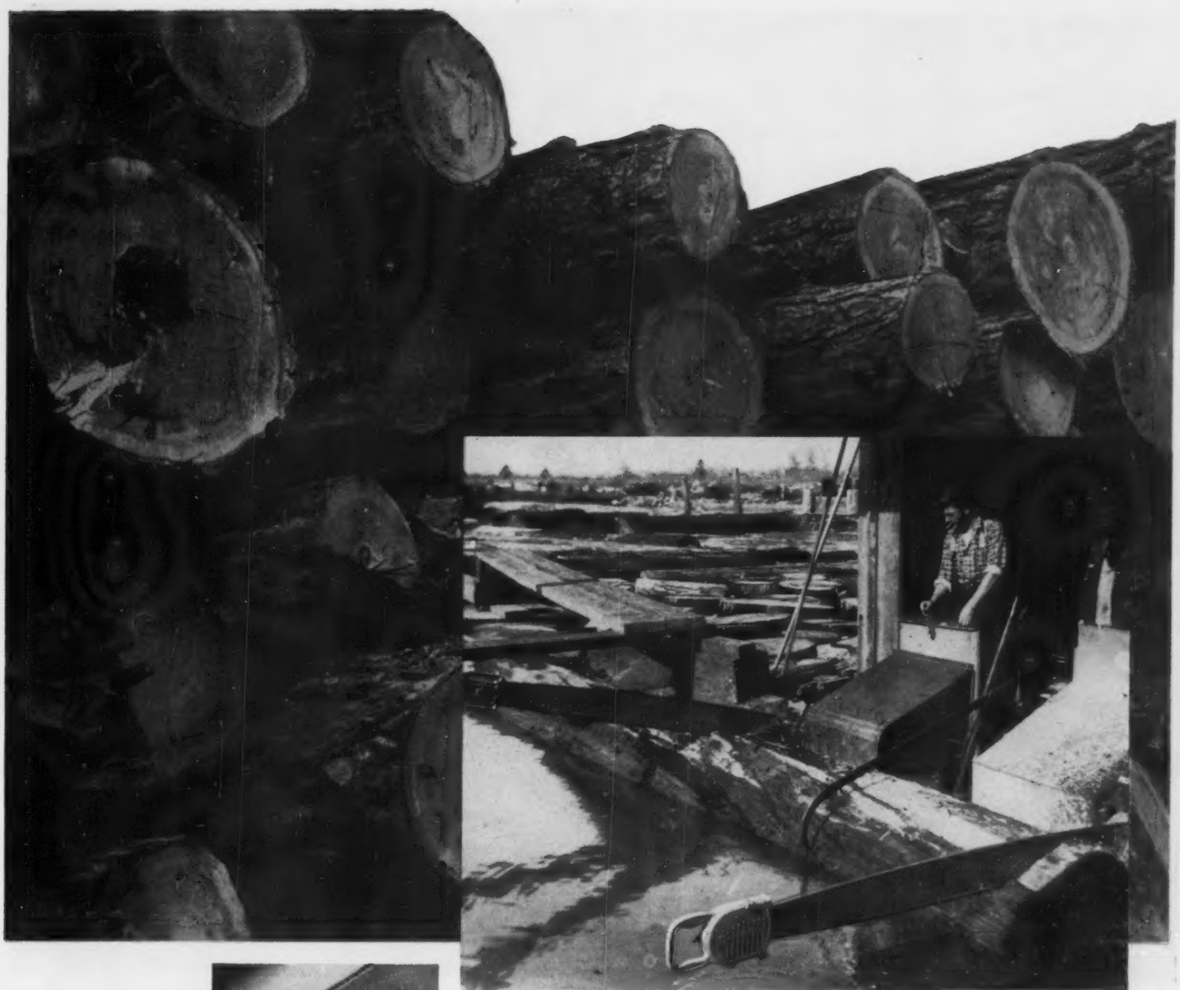
HOLE BARNESDRIL FINISHING

**BARNES DRILL CO.**

820 Chestnut Street • Rockford, Illinois



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

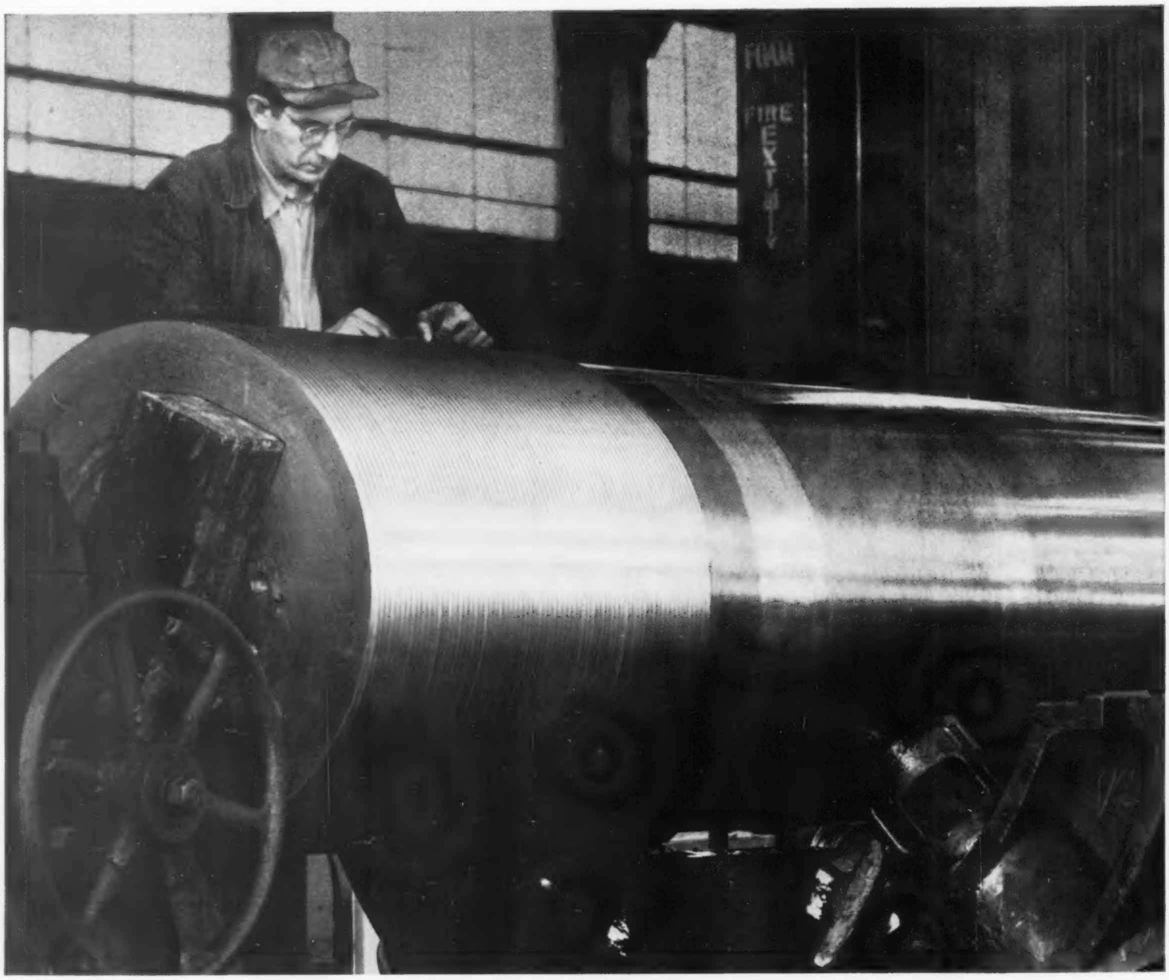


▲ L-M pond-type chain saws "bucking" log for a veneer plant.

◀ Close-up of MAX-EL alloy steel chain saw bar, showing depth of heat treatment for tougher, longer-lasting bars.



For more information on products advertised, use Inquiry Card, page 235



# It had to be more than just big

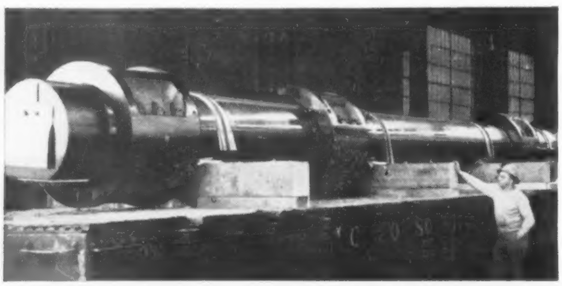
This husky column stacks up as one of the most interesting jobs we've done in some time. Designed for a 15,000-ton hydraulic press, it is more complex than you might suspect at a casual glance.

The column proper, 50 ft long, is a heavy forging machined to a shipping weight of 73 tons. An axial hole nearly 10 in. in diameter runs through the entire length of the piece. Four big cylindrical nuts are threaded onto the column at specified intervals.

These nuts are castings. When in place on the column, they bring the weight of the assembly to almost 82 tons. Each of the nuts consists of two halves that are bolted together.

The job was done from beginning to end in the Bethlehem shops. It started with the making of the steel; later came all the steps of forging, casting, treating, rough- and finish-machining. It is an excellent example of Bethlehem's completely integrated services.

And don't forget, those services are always available for small jobs, as well as big ones. Though equipped to make pieces in excess of a hundred tons, we can also make you tiny drop forgings that hardly weigh a pound.

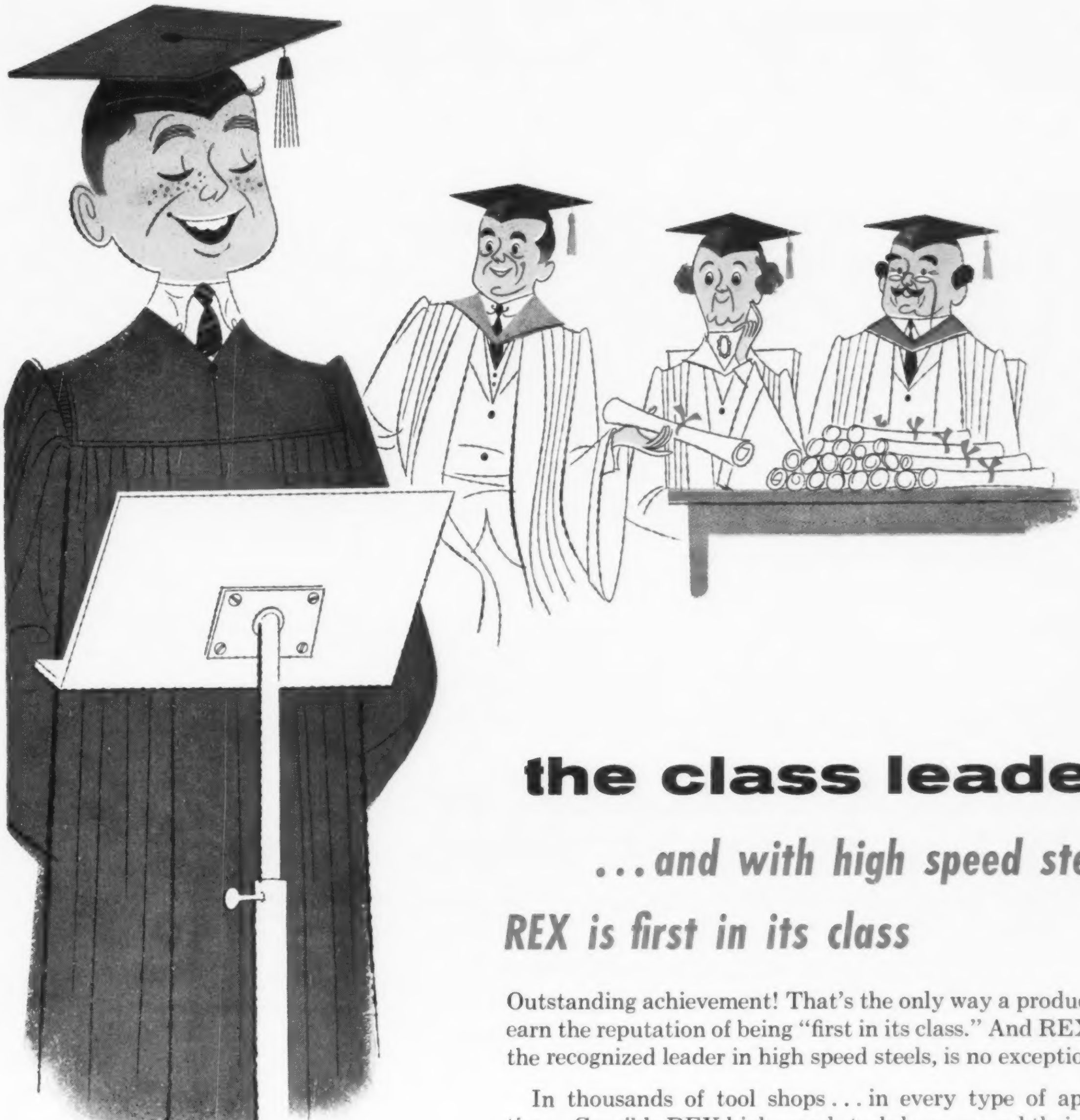


BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

**BETHLEHEM STEEL**



# the class leader

## ...and with high speed steels

## REX is first in its class

Outstanding achievement! That's the only way a product can earn the reputation of being "first in its class." And REX®, as the recognized leader in high speed steels, is no exception.

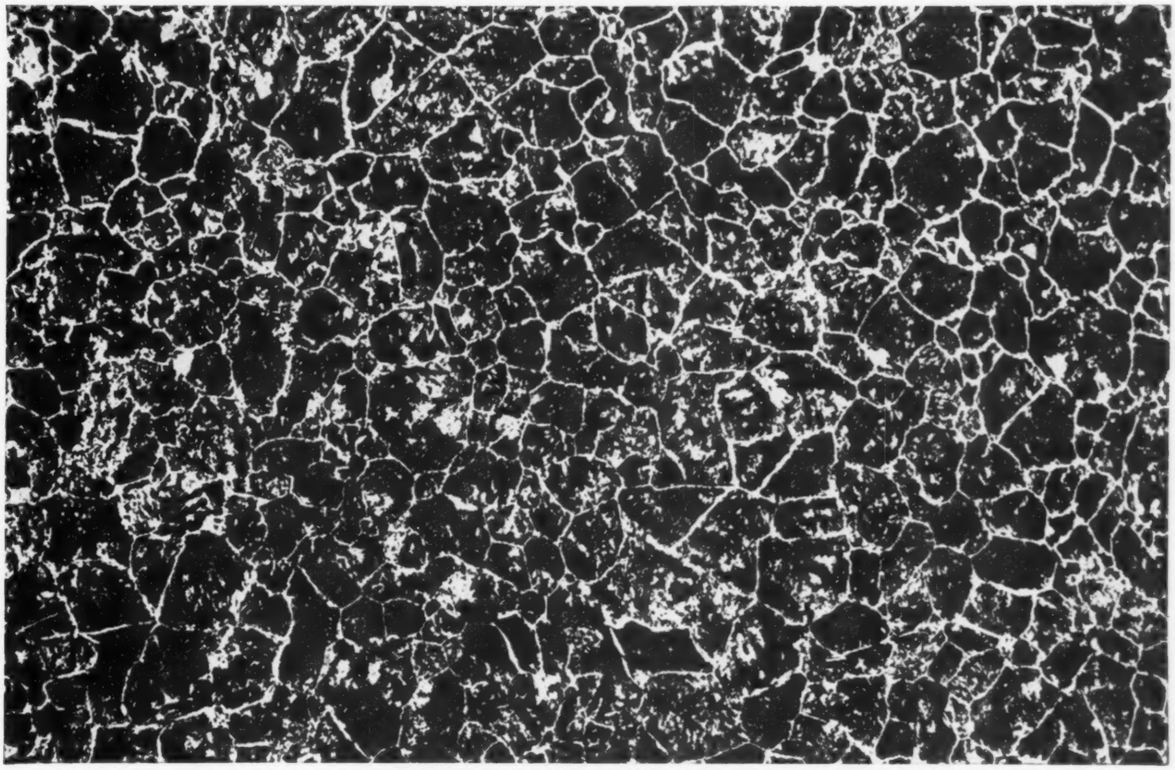
In thousands of tool shops . . . in every type of application – Crucible REX high speed steels have proved their superiority for over half a century. But it's performance in *your* shop that counts! Try REX on your next job. Test it for size, structure, response to heat treatment, fine tool performance. And you, too, will say REX is *first in its class.*

REX is made only by Crucible. It's available immediately from local Crucible warehouses . . . or by prompt mill delivery. To find out about REX and the many other types of Crucible special purpose steels, write today for "Crucible Publication Catalog." *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

**CRUCIBLE** **first name in special purpose steels**

**Crucible Steel Company of America**

For more information on products advertised, use Inquiry Card, page 235



# See for yourself why TIMKEN® forging steels give you uniform, high quality forgings

NOTE the uniform grain size in this photomicrograph of Timken® forging steel. We examine every heat of Timken forging steel—spectrographically to assure uniform grain size. As a result, you can be sure that forgings made from Timken forging steels will give you uniformly high ductility and resistance to impact.

Because your order of Timken forging steel is handled individually in our mill we are able to target our conditioning procedure to your particular forging requirements. That minimizes your rejects.

Every lot of Timken forging steel responds uniformly to heat treatment because every lot has the same physical and chemical properties. For example, we rigidly control chemistry with the help of a direct-reading spectrometer which tells us the exact composition in 40 seconds . . . while the steel is still molten.

To top it off, Timken steel forging bars *save* you steel because their good dimensional tolerances produce uniform weight multiples with a minimum of steel lost in flashings. Get all these results in your forgings. Specify Timken forging steels. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH


SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

For more information on products advertised, use Inquiry Card, page 235

# 2 Stainless Parts...

## made to the same specs...
## *but what a difference!*

**Tool life increases 33%**

This shaft winds the main spring that powers parking meter clocks. When produced from ordinary Type 303 Stainless, machinability was a constant problem . . . tool life was short. Then the company made just *one* change—to Carpenter Stainless No. 8 (Type 303). Now machines run 1/3 longer before tools have to be removed for resharpening.

**Unit costs go down**

In addition to the savings gained by longer tool life, the uniform, free-machining qualities of Carpenter No. 8 (Type 303) have helped make this job more economical. Now, material can be run at a higher speed. Close tolerances are more easily held.

**Top corrosion resistance obtained**

Although machinability was the prime factor for changing to Carpenter No. 8, the shaft had to be corrosion resistant to provide dependable performance when exposed to varying atmospheres in all parts of the country. And Carpenter Stainless No. 8 assured this property.

This is just one example where the difference in Carpenter *quality* and dependability pays off. It's a difference that can add up to speed, performance and profits right in your own plant. See for yourself—specify Carpenter on your next order for Free-Machining Stainless.

**take the problems out of production**

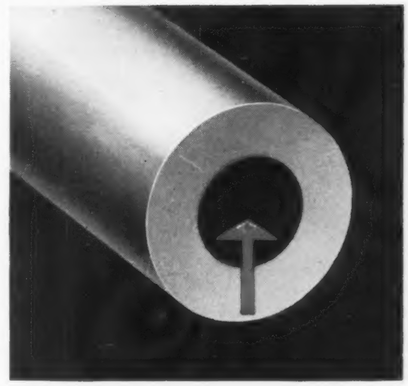
**. . . change to Carpenter STEEL** — **Free-Machining Stainless**

*IMMEDIATE DELIVERY* from local warehouse stocks!
THE CARPENTER STEEL CO., 105 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"



For more information on products advertised, use Inquiry Card, page 235

a hole here costs money...



a hole here saves money

*Crucible Hollow Tool Steel Bars* put savings into the pockets of the metalworking industry. There's no need for costly drilling, boring, cutting-off or rough-facing operations. For the hole is already in the steel you buy. You save production time, machine capacity—avoid scrap losses.

Crucible Hollow Tool Steel Bars are now available in any of our famous tool steel grades . . . in almost any combination of O.D. and I.D. sizes. And you get *immediate* delivery of five popular grades — KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot-work tool steels.

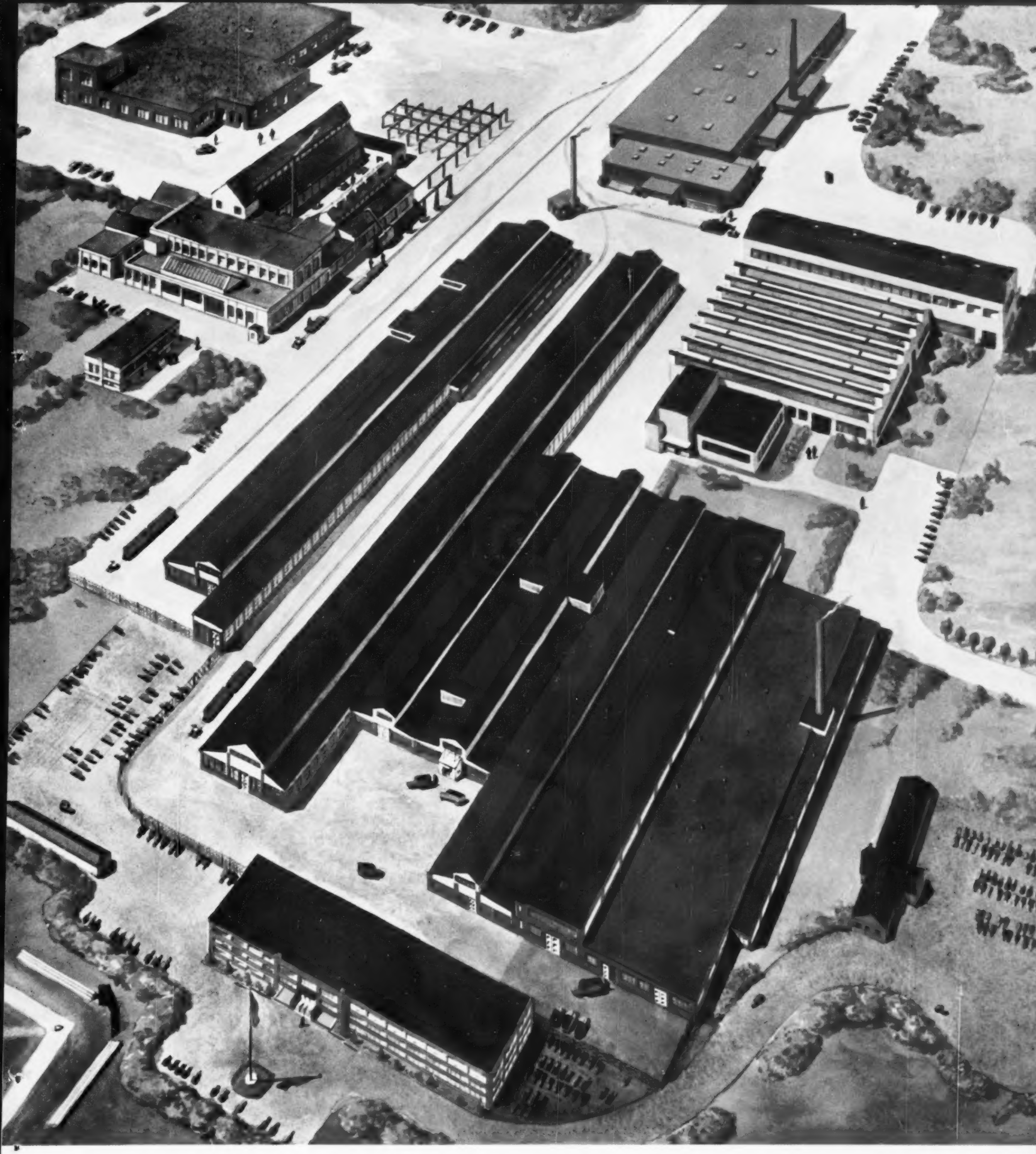
Your Crucible representative can show you how to save time and money with Crucible Hollow Tool Steel Bars. *Crucible Steel Company of America, Oliver Building, Pittsburgh 30, Pa.*

**CRUCIBLE** **first name in special purpose steels**

**Crucible Steel Company of America**

For more information on products advertised, use Inquiry Card, page 235

For more information on products advertised, use Inquiry Card, page 235

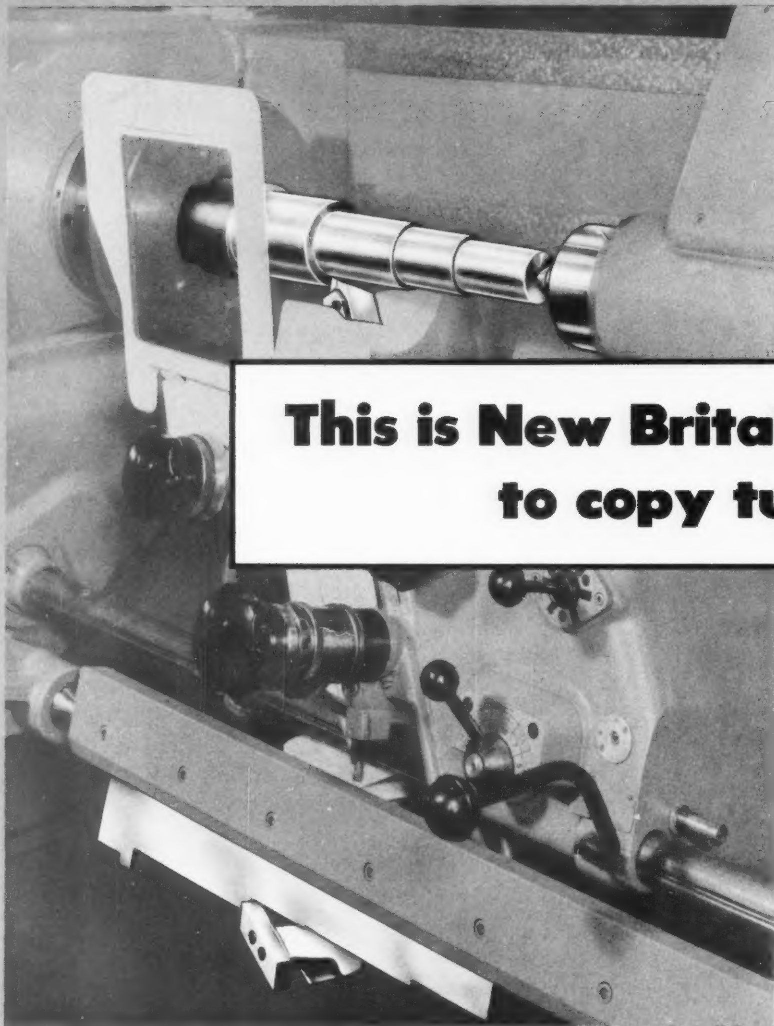


# This is The New Britain Machine Company...

*A composite view of The New Britain Machine Company's six plants in New Britain, Connecticut; Springfield, Massachusetts; Cleveland, Ohio; and Dayton, Ohio . . .* built on a foundation of sixty years of service to the world's metal-working industries. Its machine tool divisions produce:

- **Automatic Bar Machines**
- **Automatic Chucking Machines**
- **Precision Boring Machines**
- **New Britain +GF+ Copying Lathes**
- **Lucas Precision Horizontal Boring, Drilling and Milling Machines**
- **Special Automatic Metalworking Machines**

For news of New Britain developments that could improve *your* production methods, see the four following pages.

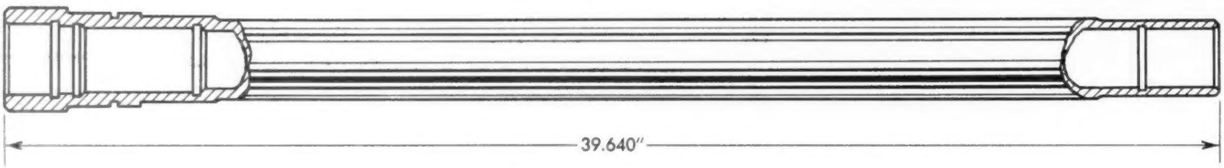


### See it in operation

Ask your New Britain representative for a showing of the color motion picture "A NEW APPROACH TO COPY TURNING." Or write The New Britain Machine Company, New Britain, Connecticut.

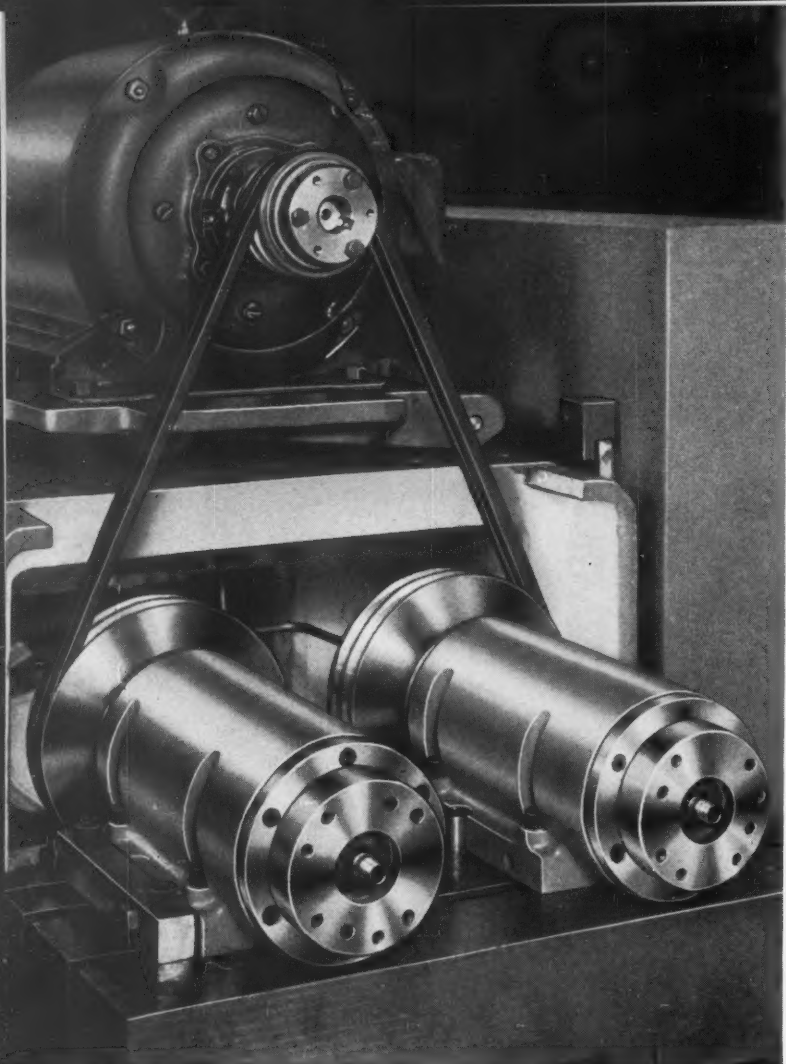
# This is New Britain's approach to copy turning

Can you find profit opportunities in *your* shop with this new approach? Let your New Britain man help you . . . that's his business.




## Saves $10 per piece and $3,000 worth of gauges plus labor and overhead on two machines

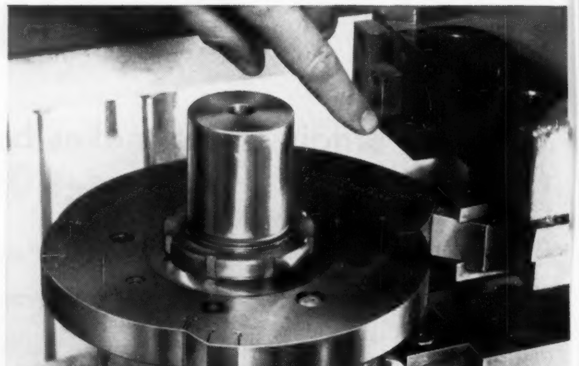
These are the five operations which formerly required four separate set-ups on three different machines: (1) Rough turn three Outside Diameters, (2) rough turn four Outside Diameters, (3) face large end, center, bore three Inside Diameters, undercut and chamfer three surfaces, (4) face end to length, bore center and undercut, (5) finish turn six Outside Diameters, undercut, form radii and chamfer — all this machining is done in five operations on one New Britain +GF+ Copying Lathe.






NEW BRITAIN

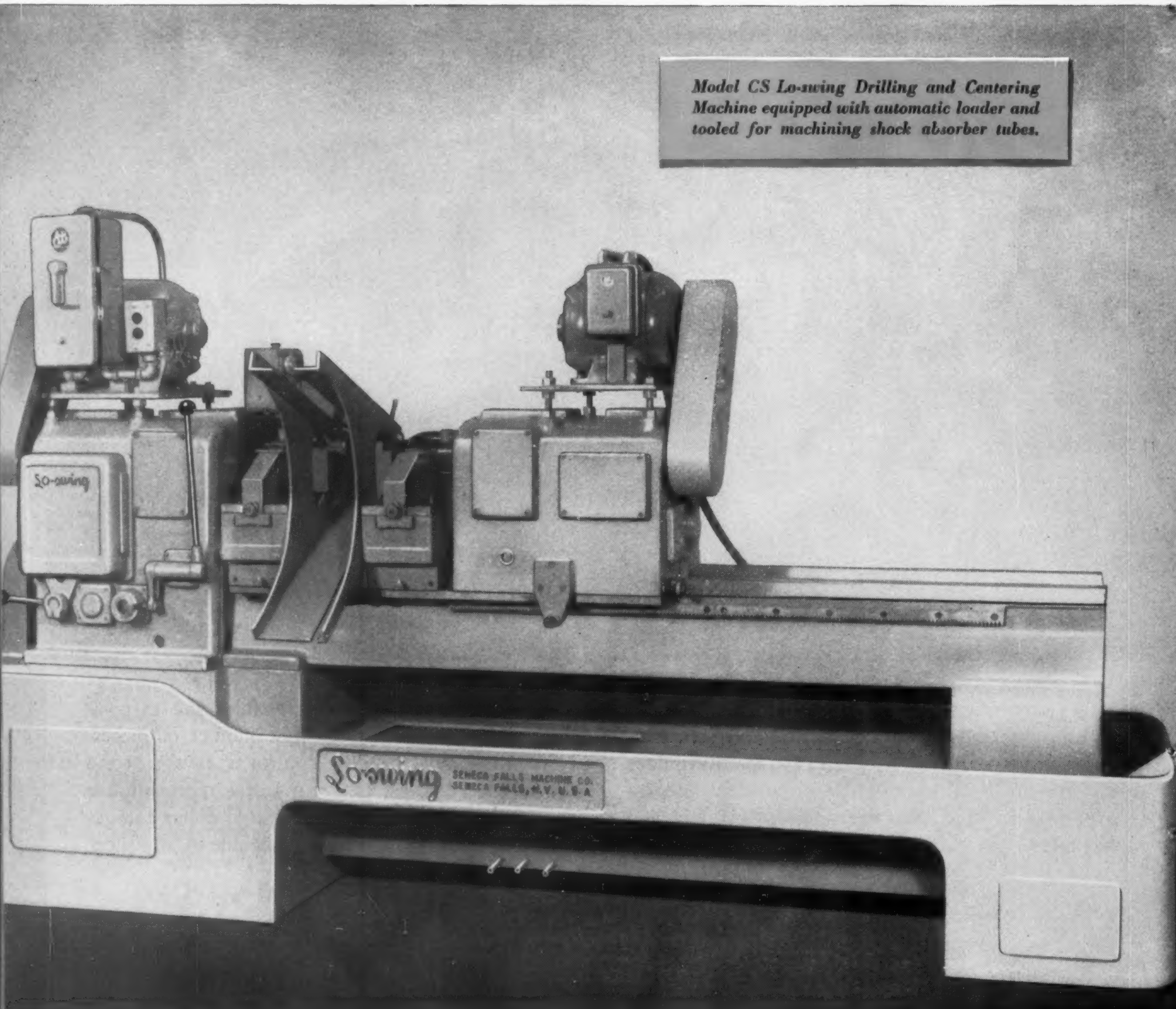




# MACHINE OF PRODUCTION COSTS

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

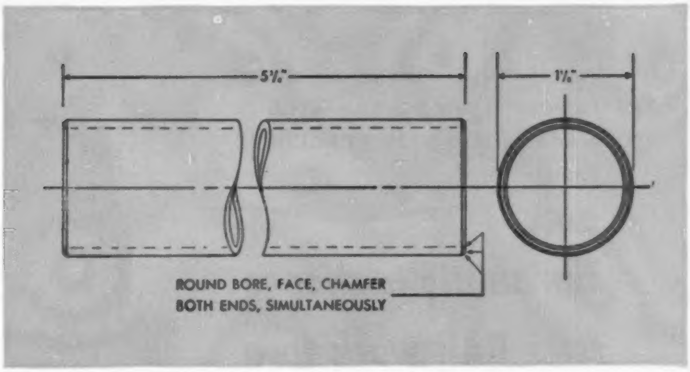
## MODEL "CS" Lo-swing SPEEDS MACHINING OF SHOCK ABSORBER TUBES




*Model CS Lo-swing Drilling and Centering Machine equipped with automatic loader and tooled for machining shock absorber tubes.*

# THE MONTH

THE MACHINE TOOL SHOW
CHICAGO, ILL.
INTERNATIONAL AMPHITHEATRE

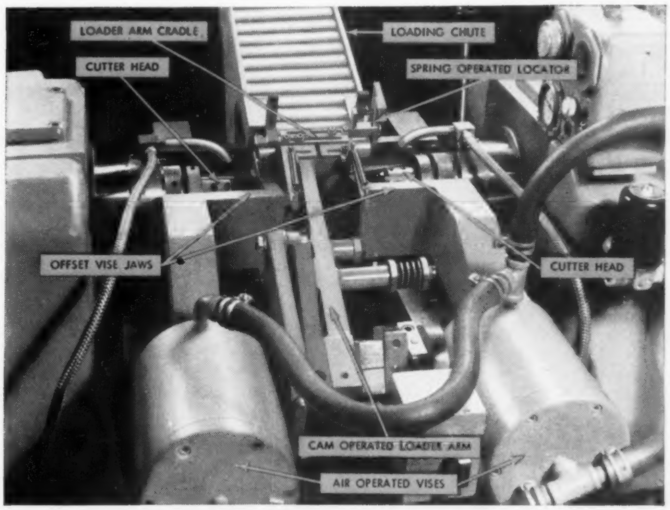



**PROBLEM:** To automatically load, unload and machine both ends of Hydraulic Shock Absorber Tubes at high production rate.

**SOLUTION:** The Model "CS" Lo-swing Automatic Drilling and Centering Machine selected for this job was equipped with an automatic loader of the type shown in the small illustration.

The tubes, which are cut 1/16" over the required length, are fed into the upper chute, shown in the large illustration, and ejected into the lower chute after being machined. Details of the loading arm, which is cam operated, are also shown in this illustration. Tubes are fed by gravity down the loading chute into the loading arm cradle where they are properly positioned lengthwise by a spring operated locator. The loading arm then lowers the tube into the air-operated vise jaws where it is securely clamped, after which the loading arm is raised to pick up the next piece.

When the loading phase of the cycle is completed, the two revolving cutter heads advance in rapid traverse and slow down into feed just before the tools reach the work. Three cutters are used in each head . . . one cutter for facing to overall length, one for rounding the bore, and one for chamfering the O. D. The machining completed, the cutter heads retract in rapid traverse and the vise jaws open, allowing the finished part to drop into the unloading chute. The complete cycle is slightly under five seconds per piece, assuring a production of 750 pieces per hour.




Engineered jobs are our specialty. Seneca Falls is at your disposal to assist in solving your problem.

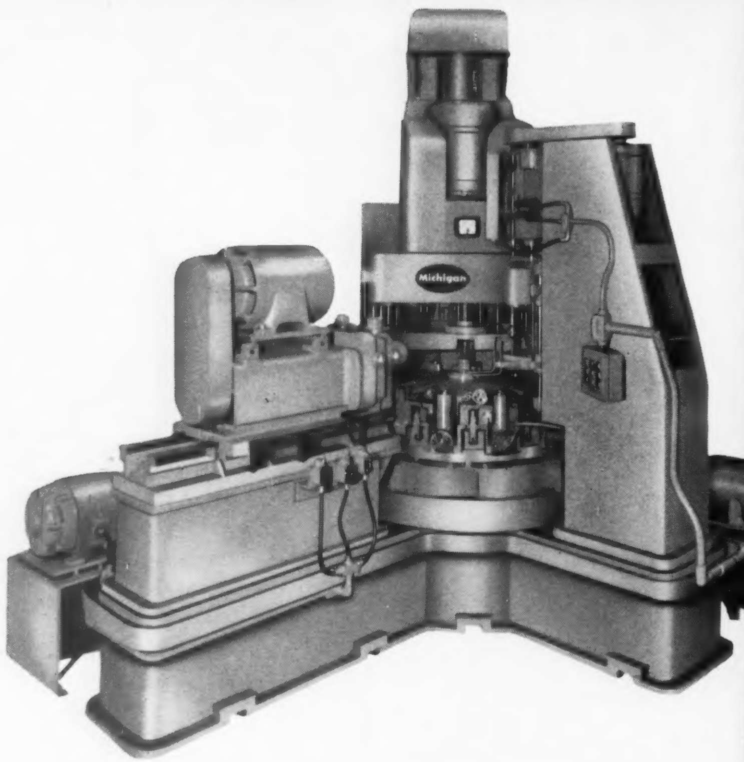
**SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.**

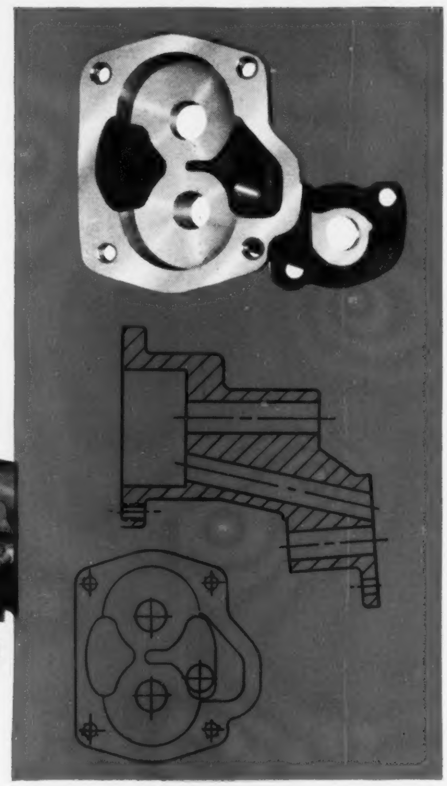
# ARE LOWER WITH *Lo-swing*

For more information on products advertised, use Inquiry Card, page 235

# Here's a Production Team

## 120 OIL PUMP BODIES

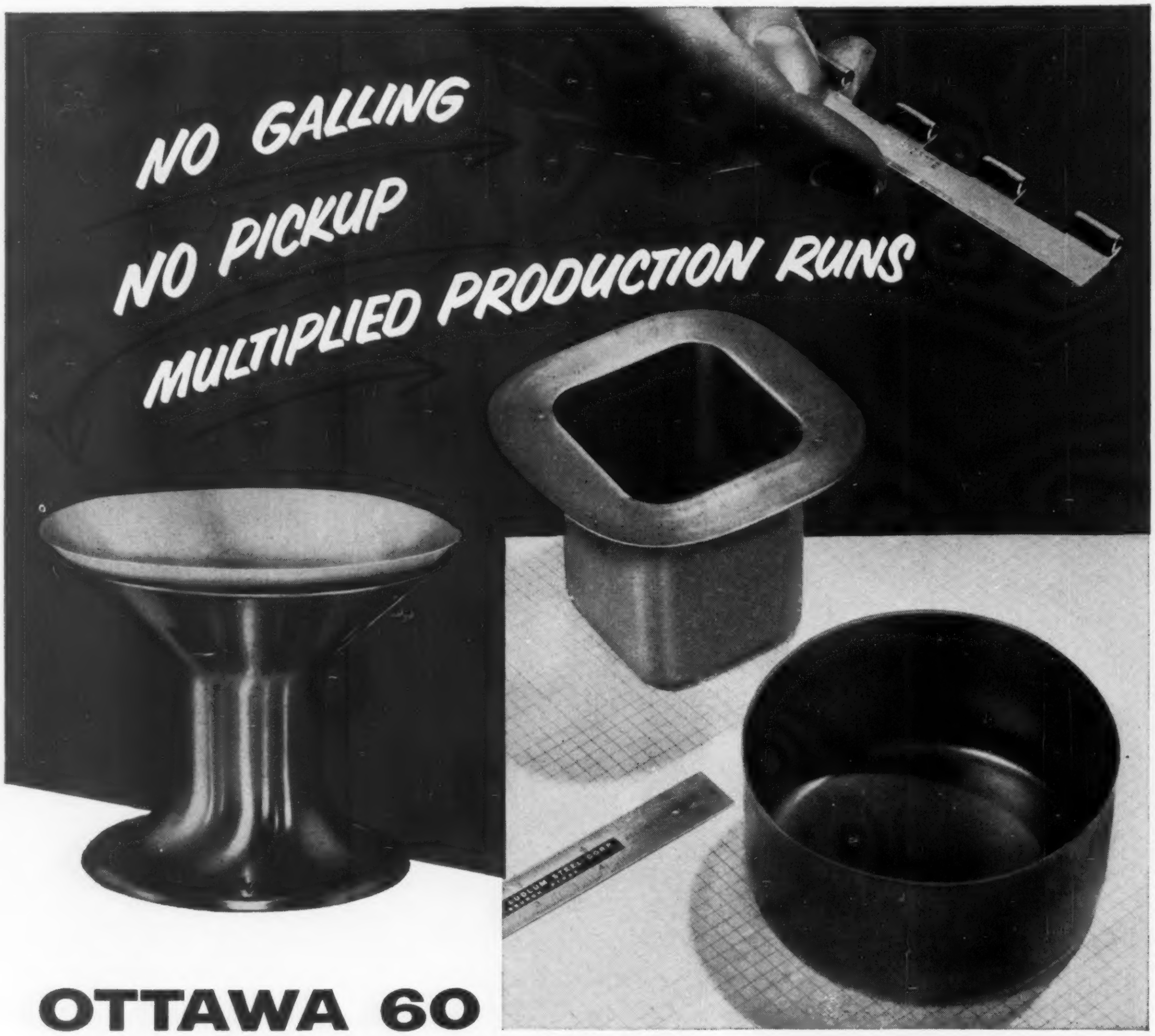


### AUTOMATED OPERATIONS ON MACHINE NO. 1

| | | |
|---|---|---|
| **1.** Rough mill the top face. | **5.** Chamfer the .4845 hole; Chamfer the first (2) mounting holes; and, rough bore one gear pocket. | **8. Finish bore** and square bottom other gear pocket. |
| **2. Finish mill** the top face. | **6.** Chamfer the .4785 hole; Chamfer the other (2) mounting holes; and rough bore the other gear pocket. | **9.** Tap all (4) mounting holes in top face. |
| **3.** Drill thru the .4845 hole; and, tap drill (2) mounting holes. | **7. Finish bore** and square bottom of one gear pocket. | **10. Finish ream** the .4845 hole. |
| **4.** Drill thru the .4785 hole; and, tap drill (2) mounting holes. | | **11. Finish ream** the .4785 hole. |
| | | Ready for Second Machine |

# For Faster, More Economical Production




# OTTAWA 60

## for DRAW DIES is *NEW...and NEWS!*

**Write for a copy of the OTTAWA 60 BLUE SHEET**

This Blue Sheet contains certified data on the physical characteristics of Ottawa 60, prepared from carefully checked laboratory and field service tests. All the information you'll need on methods of handling and heat treatment, etc.

**ADDRESS DEPT. M-67**

In fact, this exclusive Allegheny Ludlum-developed die steel is mighty *good* news for any user of draw dies. Ottawa 60 is a high-carbon, high-vanadium analysis, initially designed for the primary purpose of drawing stainless steel.

In that service, Ottawa 60 does just exactly what it was developed to do: it performs without galling or pickup, and shows exceptional wear-resistance—as a long list of successful applications will prove to you. Two of them are illustrated above: a stainless hinge and a stainless sundae server.

*But Ottawa 60 is a top performer on any draw die application!* Also illustrated above are the two draws on a transformer housing of .037″ gauge SAE 1010 strip. After more than 25,000 pieces—*over 12 times any previous runs*—there was still no sign of pickup, or of wear on the Ottawa 60 punch or die.

This analysis can solve your draw-die problem jobs—or reduce your costs on almost any drawing operation. ● Call on our Mill Service Staff for any assistance. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

For complete **MODERN** Tooling, call

**Allegheny Ludlum**

W&D 5581

A-L® FINE TOOL STEELS SINCE 1854



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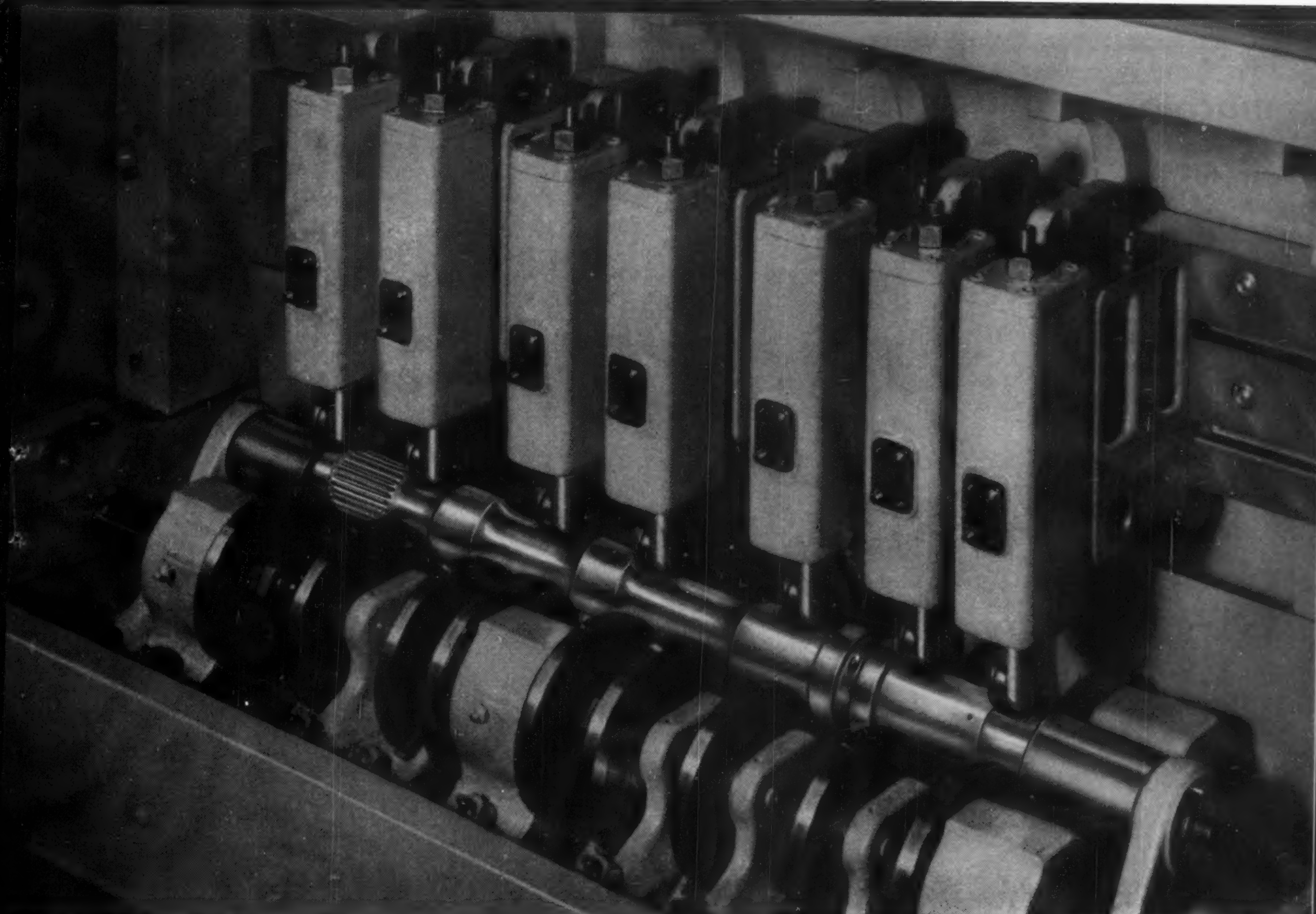
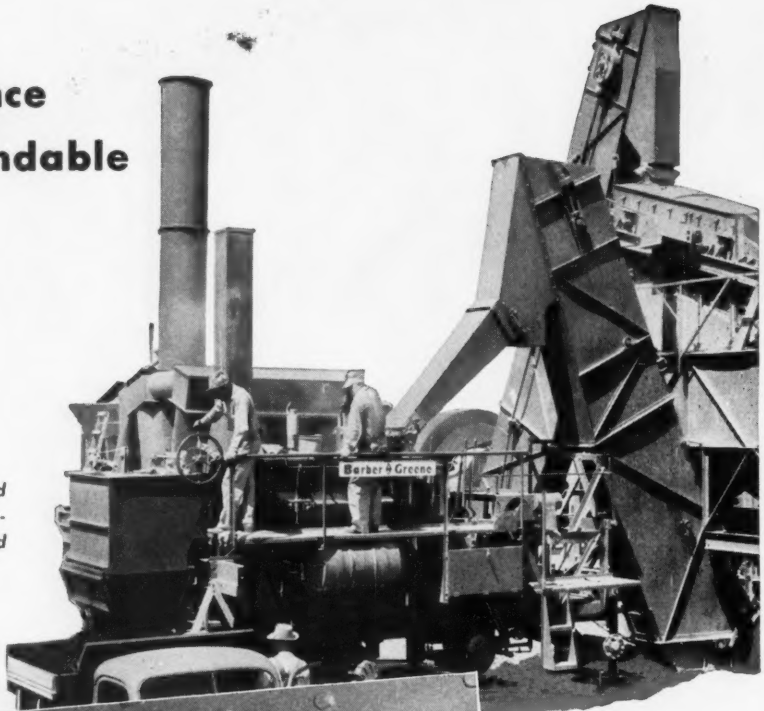


## machines of great performance use the most dependable oiling system ever developed




*A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.*

## MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.

**kipp**

**MADISON-KIPP CORPORATION**

**203 WAUBESA STREET • MADISON 10, WIS., U.S.A.**

- **Skilled in Die Casting Mechanics**
- **Experienced in Lubrication Engineering**
- **Originators of Really High Speed Air Tools**



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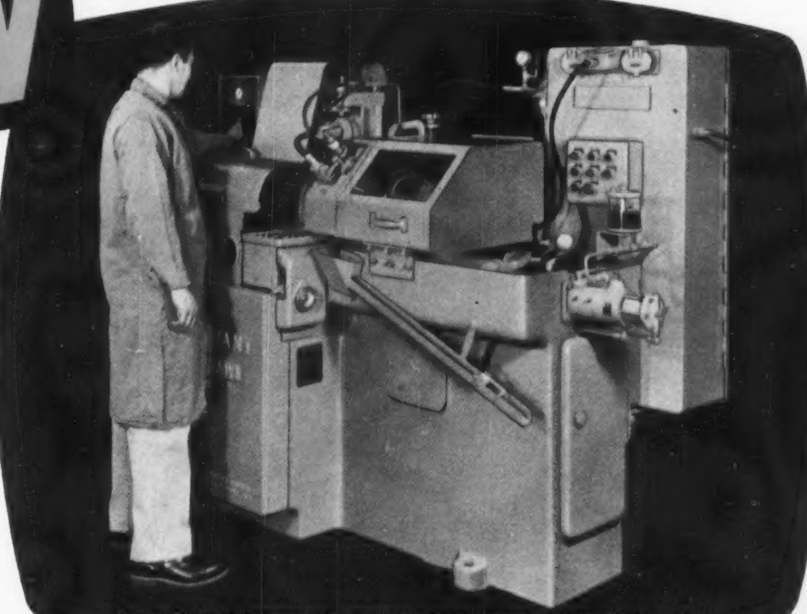
**NEW**

# BRYANT air sizing . . .



Bryant #2209-Y Automatic Internal Grinder equipped with Bryant Air Sizing for automatic size control of bores


## holds closer tolerances in internal grinding than any other sizing method!

This new method of sizing is designed especially for automatic production. It's extremely accurate, time-saving and economical—ideal for straight hole grinding when high-speed production, close tolerances and fine finishes are desired.

Bryant Air Sizing utilizes three principal operating components: Air Gage Panel, Bryant Impulse Timer and the Air Plug.

The Air Plug is mounted through the workhead and traverses continuously into the workpiece during the finish grinding cycle. Oscillation is timed and controlled from the wheelslide.

The Air Gage Panel measures the pressure peaks which occur at the air plug orifices each time the Air Plug enters the workpiece. These pressure peaks are multiplied to make gaging faster and more sensitive, and are then converted from pressure values into electrical impulses which operate the Bryant Impulse Timer.

The Timer continues the grinding cycle until the impulse signals stop, indicating that size has been reached. It then stops the grinding cycle and initiates the automatic loading cycle.

Bryant Air Sizing controls the size of workpieces *during the finish grinding cycle.* There is no contact between the gaging element and the workpiece. As a result, wear of the gaging element and possible scoring of the workpiece is eliminated.

Diamond sizing is used with Bryant Air Sizing to control size during the rough grind operation. *Write for descriptive literature.*

Be sure to see Bryant at the Machine Tool Show, *Booth 1015*

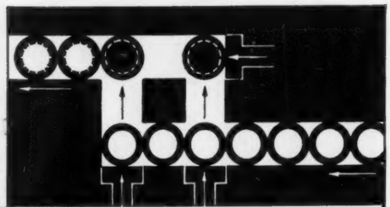
**BRYANT** chucking grinder co.

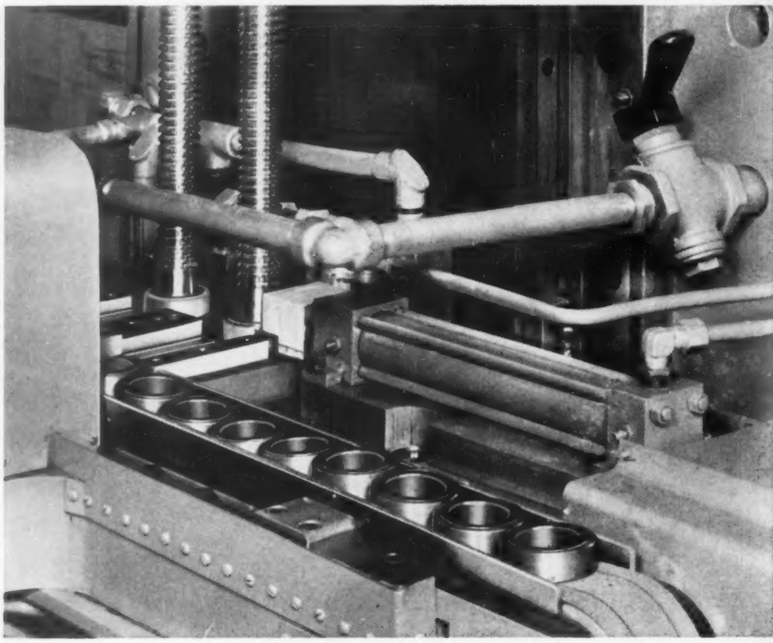
20 CLINTON STREET, SPRINGFIELD, VERMONT

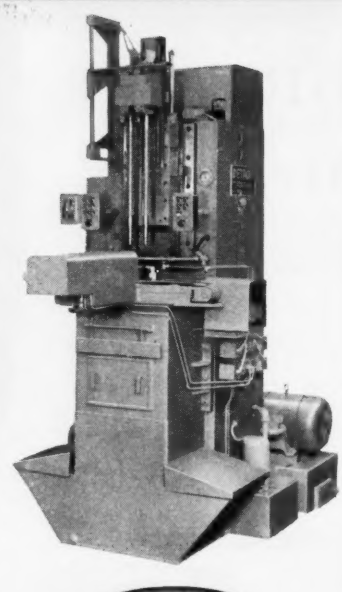
Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

*Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates*

# AUTOMATION IN BROACHING!








## DETROIT BROACH PROVIDES FULL AUTOMATION WITH FLEXIBILITY OF MANUAL OPERATION

In the designing and manufacture of automatic tooling for this Pull Down Internal broaching machine, Detroit Broach combined all the time and labor saving advantages of automation, plus versatility to permit efficient manual operation when required. This standard machine is designed to support the tail of the broach throughout the entire stroke and, if desired, may be arranged to hold the tool in tension throughout the cut.

On this particular job, parts are loaded, broached and unloaded automatically—maintaining consistent, high quality production WITHOUT AN OPERATOR! Parts are fed to the machine fixture and then carried away on a belt conveyor.

In addition, this machine features:

**OPERATION**
Broaching 39 involute spline teeth and size minor diameter

**PRODUCTION**
480 pieces per hour (100% hour)

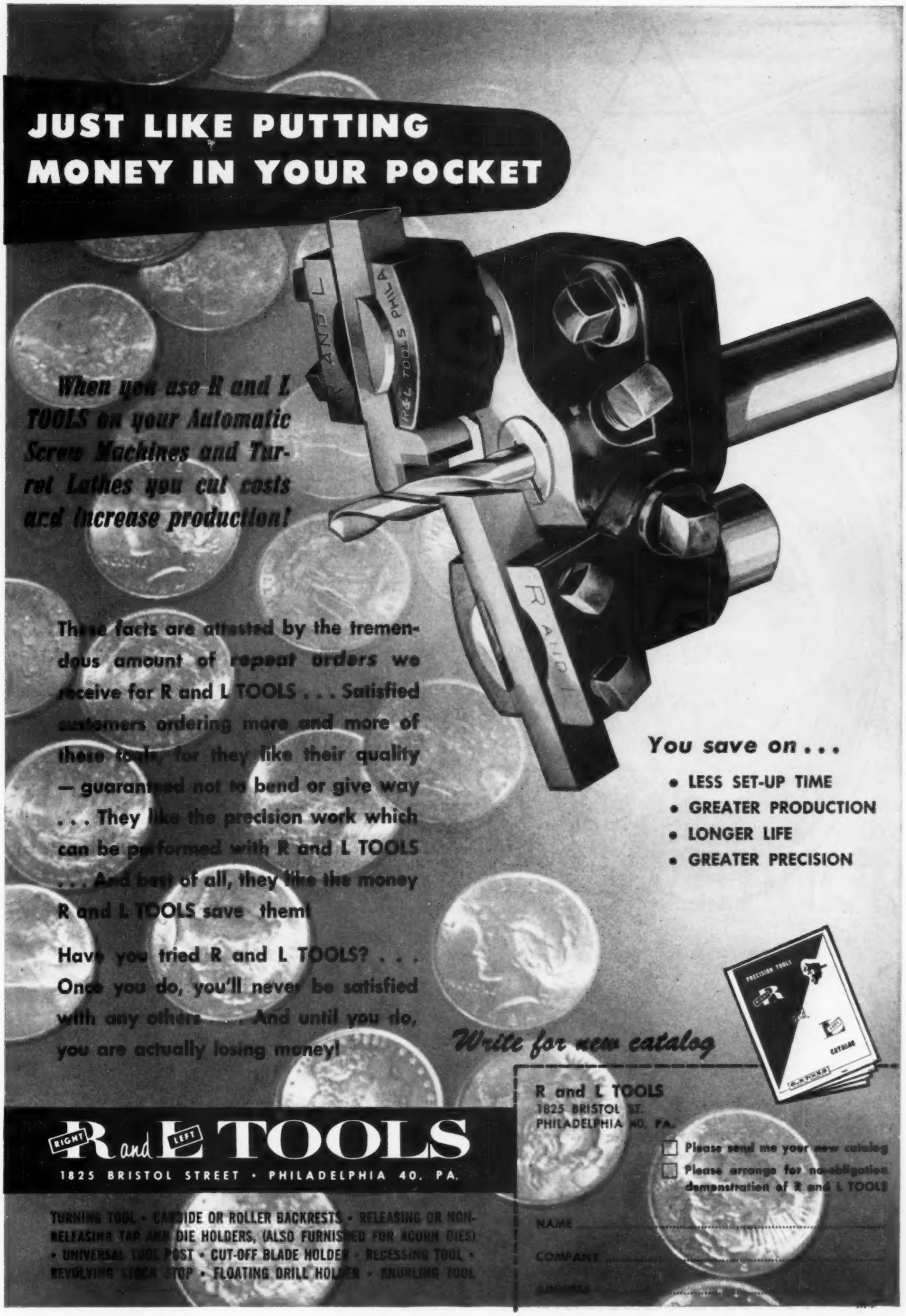
**MACHINE**
Detroit Broach 10-ton Vertical Pull Down Broaching Machine with 42" stroke.

1. An automatic safety mechanism which must be actuated by both broaches at the top of the stroke before the unloading cylinder will eject the finished parts. This eliminates any possiblity of costly tool breakage and down time.
2. Should anything interrupt this machine's automatic cycle, an operator can step in and run full production manually until automatic cycle is resumed.
3. Use of standard components wherever possible to keep costs low and to assure simple, time-saving maintenance or replacement.
4. Fixtures designed and built for greatest flexibility . . . for easy conversion to hold other parts or for design changes on present parts.
5. Simplicity of design and construction for convenient accessibility . . . for quick, easy inspection and maintenance.

*Why not find out how you, too, can benefit from new broaching techniques and tooling advancements. Our sales engineers will be glad to consult with you at your convenience.*

Detroit Broach COMPANY
ROCHESTER, MICHIGAN

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

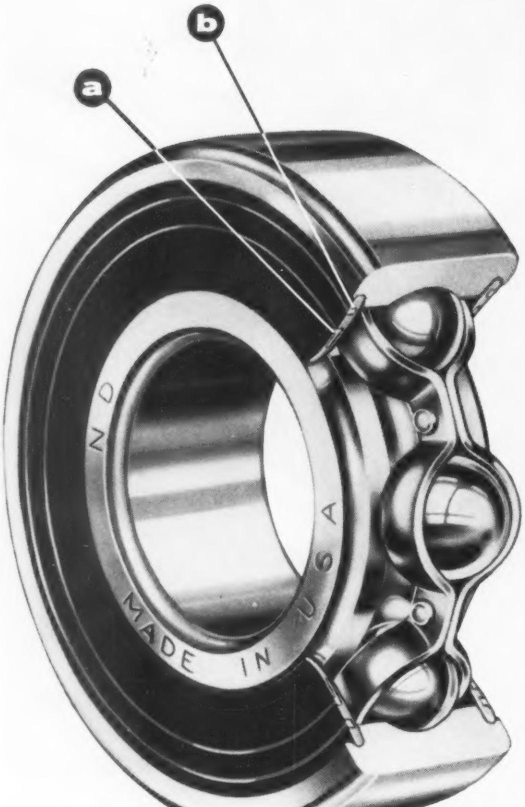


JUST LIKE PUTTING MONEY IN YOUR POCKET
When you use R and L TOOLS on your Automatic Screw Machines and Turret Lathes you cut costs and increase production!
These facts are attested by the tremendous amount of repeat orders we receive for R and L TOOLS . . . Satisfied customers ordering more and more of these tools, for they like their quality — guaranteed not to bend or give way . . . They like the precision work which can be performed with R and L TOOLS . . . And best of all, they like the money R and L TOOLS save them!
Have you tried R and L TOOLS? . . . Once you do, you'll never be satisfied with any others . . . And until you do, you are actually losing money!
You save on . . .
• LESS SET-UP TIME
• GREATER PRODUCTION
• LONGER LIFE
• GREATER PRECISION
Write for new catalog
R and L TOOLS
1825 BRISTOL ST.
PHILADELPHIA 40, PA.
Please send me your new catalog
Please arrange for no-obligation demonstration of R and L TOOLS
NAME
COMPANY
RIGHT R and LEFT L TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

# FACTS

about

## NEW DEPARTURE
BALL BEARINGS

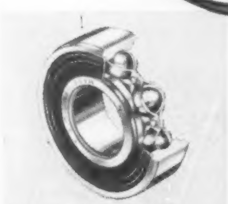


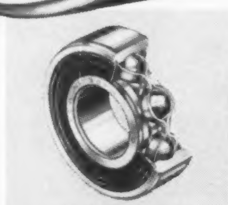

## New Sentri-Seal...on guard against dirt and wear!

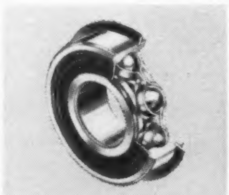
The unique design of the Sentri-Seal gives optimum protection against dirt, and includes a number of other major advantages.

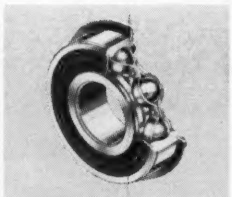
Sentri-Seals are quickly removed, easily replaced. As the seal is of synthetic rubber, in which two metal rings are embedded, a constant-rate spring is created between the rings. Inherent flexibility prevents distortion of the bearing outer ring due to seal insertion, permitting the use of bearings to the higher accuracy specifications. The spring action maintains an efficient sealing contact with the bearing ring to bar dirt and retain lubricant. Sentri-Seals are relatively inert to oils and greases and operate satisfactorily through a temperature range of −40°F to 225°F. Specifications available for still higher temperatures. In applications where relubrication is desired, it is easily accomplished by the injection method.

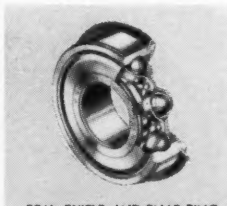
The New Departure Sentri-Seal basically consists of two separate metal rings, "A" and "B", embedded in synthetic rubber, resulting in a spring which absorbs distortion and deflection. The seal is not drastically influenced by axial displacement due to bearing end-play within prescribed tolerances, and provides efficient sealing at low torque. Bearing shown is equipped with two seals.


ONE SENTRI-SEAL


SEAL AND SHIELD

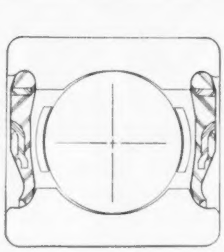

SEAL AND SNAP RING


TWO SEALS AND SNAP RING


SEAL, SHIELD AND SNAP RING

The diagram shows in section the New Departure Sentri-Seal. Lip contacting surfaces are form-ground simultaneously with the ball race, giving an extremely high degree of concentricity between sealing surfaces and the raceway.

Sentri-Seal is available for a range of sizes in single-row, standard-width bearings and also in two types of New Departure adapter bearings. Sizes, dimensions and capacities are listed in the latest New Departure catalog.



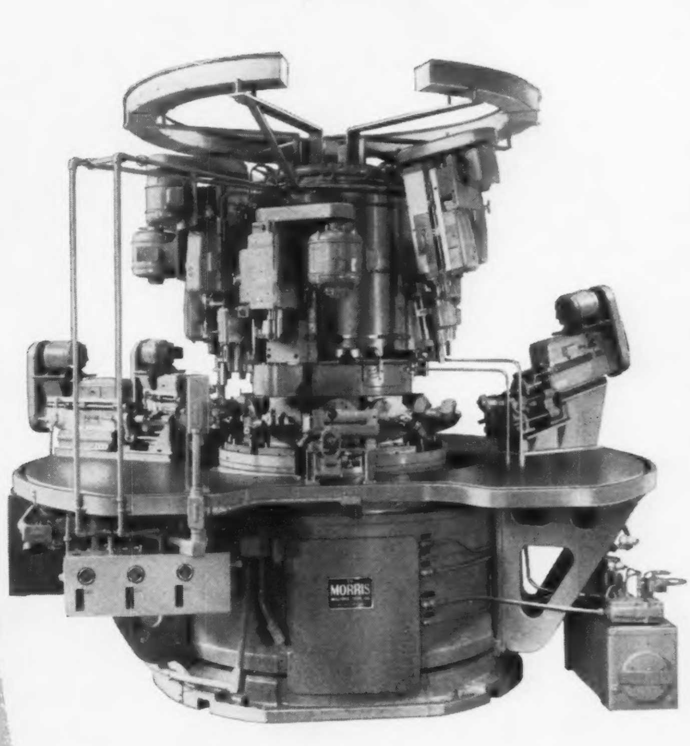
***Write for full details on Sentri-Seal***

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

**For more information on products advertised, use Inquiry Card, page 235**

# Eliminates model change-over problems!

**a production machine—with standard units—quick change-over features—for each year's design change. completely automatic—requires only part loading and unloading.**




Morris Unit-Type Machine Tools provide specialized machining; use standard components; add flexibility to your high speed mass production operations.

Unit type construction provides for re-alignment for model alterations or for new models. No longer any need to scrap an entire machine!

MORRIS MOR-SPEED PRODUCTION MACHINE . . . drills, burrs, reams, taps, spotfaces carburetor air horns . . . 375 pieces per hour at 80% efficiency.

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- **Adjustable Feed, Stroke and Rapid Approach**
- **Trouble-free Hydraulic System**
- **Wide Range of Spindle Speeds**
- **Convenient Controls**
- **Air or Oil Powered**
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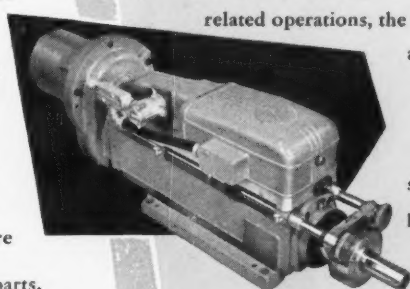

Designed for a wide range of drilling, reaming, chamfering, spot-facing, hollow milling, centering and related operations, the unit can be mounted in vertical, angular or horizontal positions. Controls may be set to provide almost any sequence of operation. Available for use in special purpose machines like the production machine illustrated.

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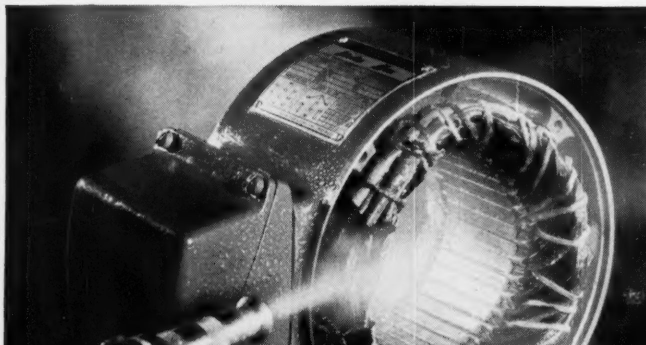

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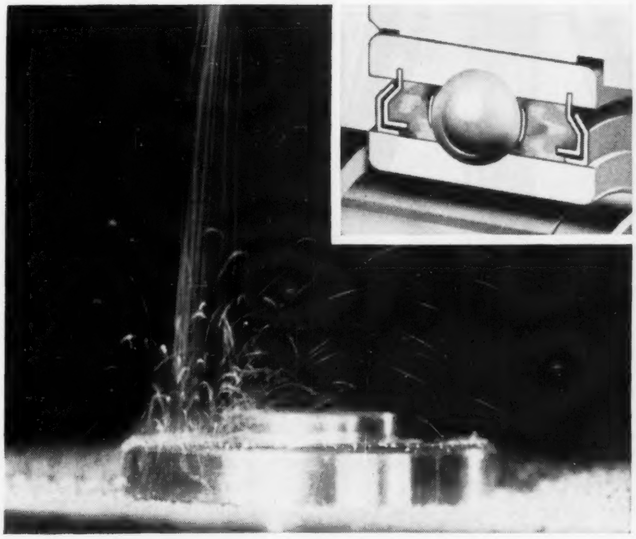

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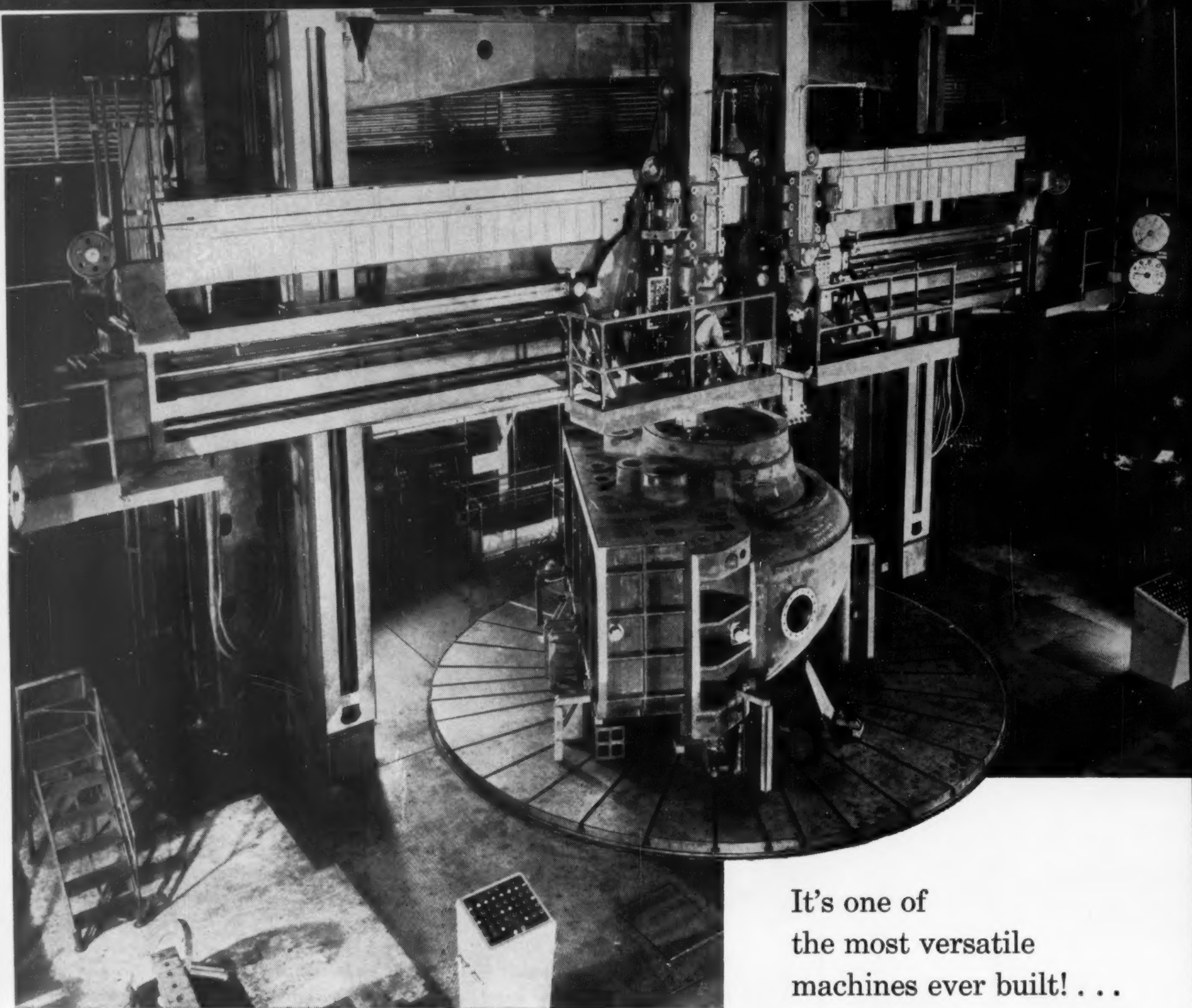

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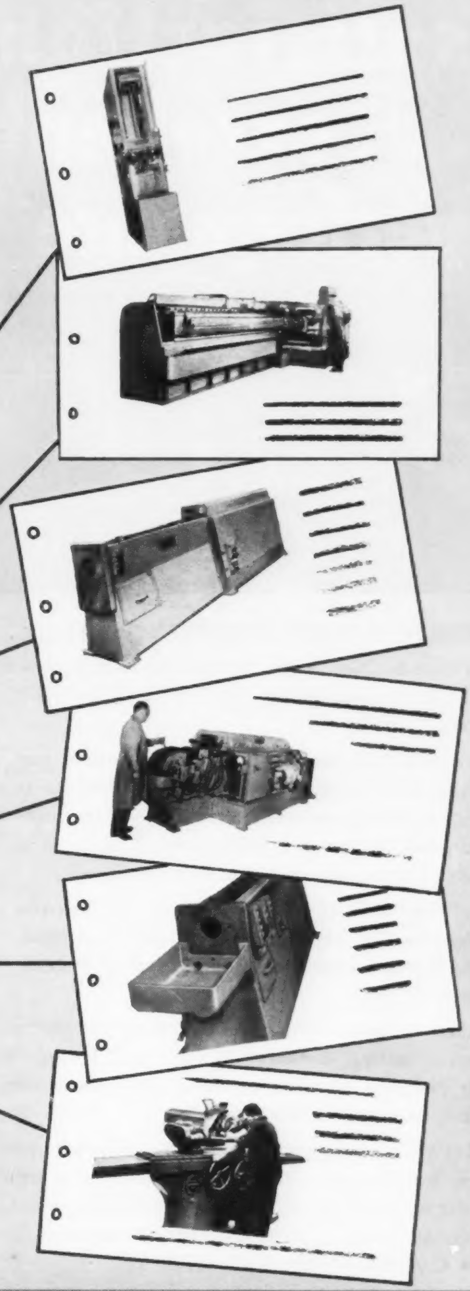

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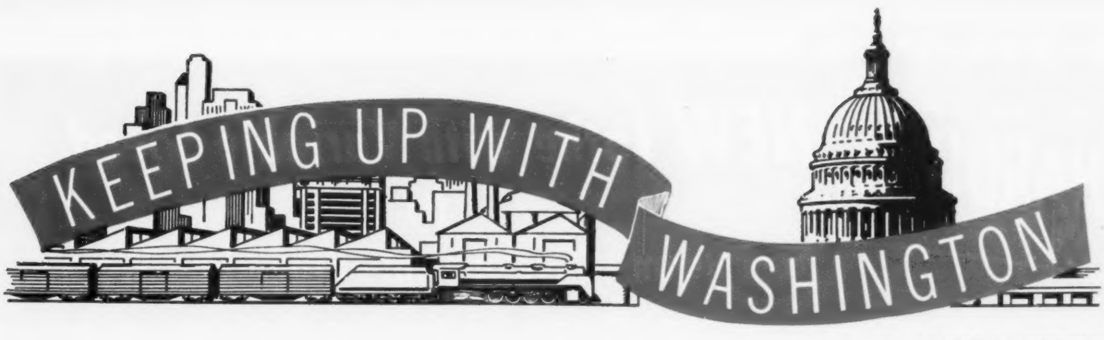


By LORING F. OVERMAN

# Machinery Outlook Bright in Civilian and Defense Fields

RECENT controversies have resulted in a lot of red faces in Washington over the question of whether the world has underestimated United Soviet Air Power. Defense Department spokesmen apparently got their signals crossed in releasing conflicting statements for public addresses on Army Day in various parts of the country. Some said the United States is years behind the Soviets; others felt we had better not sell the Reds short, but that the United States hadn't been sitting with its flaps down.

It seems evident that in any event, whether the machinery industries look to defense projects or to civilian production for 1955-56 volume, present indications are that the coming months will be busy.

### The Civilian Field

A recent report of the President's Council of Economic Advisers showed:

1. Gross national product reached an annual rate of $370,000,000,000 during the first quarter of 1955, the highest since mid-1953; $8,000,000,000 over the last quarter of 1954.

2. Based on estimates for January and February, expenditures for new plants and equipment in 1955 should reach $27,000,000,000; 1 per cent more than in 1954. Current outlook is for a 5 per cent increase between the first and second quarters, and then stability for the balance of the year.

Of further interest to the machinery industries is the fact that industrial construction appears headed for a long pull. Plant expansion, dispersals, and migrations involve ten-year planning. Unknown factors, for the moment, are the probable effect of atomic power on future manufacturing operations, and the influence of the nation's changing industrial water supply. These factors involve slow-moving forces, so there should be ample time to anticipate probable shifts.

### Military Prospects

The recent scare given our military observers when the Kremlin introduced some revolutionary aircraft in its May Day demonstrations, adds emphasis to the constant need to be not only alert but somewhat clairvoyant. Countering these revelations, our Defense Department announced:

1. Tests of supersonic rockets which have probed 123 miles skyward, carrying 195 pounds of equipment for measurements;

2. Installation of the first of a long line of offshore "islands" to serve as radar and weather observation posts;

3. Operation of the first of the 50,000-ton heavy presses which have been under discussion and planning for so long;

4. A request to Congress for more than $4,000,000 for experiments with a nuclear-powered airplane.

### Congress' Aid Asked

Authority to continue the Defense Department's program of expanding and maintaining reserve production facilities is asked in Senate Bill 1138. Present authority for the program is scheduled to expire July 1, 1955. Bill 1138 would extend the program until July 1, 1956, or six months after the end of the emergency declared in 1950, or until terminated by Congress. Speaking on behalf of the extension, Frank H. Higgins, Assistant Secretary of the Army, told the subcommittee that $100,000,000 has been asked in the 1956 defense budget to acquire and install production facilities and equipment in public or privately owned plants for current or mobilization defense production.

The Army Ordnance Corps Chief, General J. B. Medaris, told committee members that private plants are often not readily adaptable to specialized defense needs. The production reserve program, he said, has enabled the Defense Department to supplement privately owned facilities in such a way as to establish balanced production lines. Most of the plants included in the reserve, he said, are handled by private contractors. He told the committee that the programs seek to "strike a balance between reserve stock-piling of military end-items and the establishment and retention of adequate industrial capacity."

### War Powers Act Extended

Precedent for extension of the production reserve authority is seen in passage of HR 4052, extending to June 30, 1957, Title II of the First War Powers Act. The bill is of interest to machinery people and other defense contractors because it continues the authority to modify contracts where a contractor faces a loss that would impair his productive capacity. It also authorizes advance, progress, or other payments on contracts under specified conditions when such action is believed by the President to be important to national defense.

### Production Facilities Listed

A Commerce Department listing—first of its kind—is available which gives a complete breakdown by regions and states of all industrial defense expansion projects during 1950-54 as indicated by approved certificates of necessity for rapid tax amortization. According to the summary, United States industry invested $29,729,837,000 for 19,391 new or expanded defense production facilities during the five-year period, January 1, 1950, to December 31, 1954. By May 4, 1955, the total had reached 19,724 projects involving rapid tax amortization totaling $30,287,253,000.

## Washington Briefs

*Ways to cut* production costs and improve work scheduling with properly designed jigs, fixtures and gages are explained in a new leaflet prepared by the Small Business Administration. The leaflet entitled "Reducing Costs with Jigs, Fixtures, and Gages," is available free at all field offices of the agency.

*Despite the Administration's goal* of taking government out of competition with business, the Air Force finds that dual-purpose plants (making civilian products in peacetime; defense materiel during emergencies) have little place in plane production. The Air Force finds that private industry is simply not set up to maintain buildings and production equipment in idleness over long periods of time, in order to be in readiness for some unforeseen emergency.

*Firms having trouble* getting action on applications for machinery patents will be interested in a Senate authorization for $50,000 to study delays of a year or more. Senator Kilgore (D-W. Va.), in commenting on the problem, blamed the delay on ill-advised efforts to economize. He indicated that the Patent Office workload rose from 60,386 in 1952 to 75,271 in 1954. During the same period, the number of patent examiners was reduced from 720 to 610.

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ELMIRA, N.Y.

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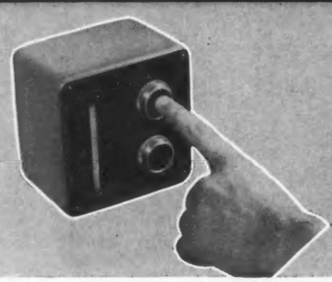

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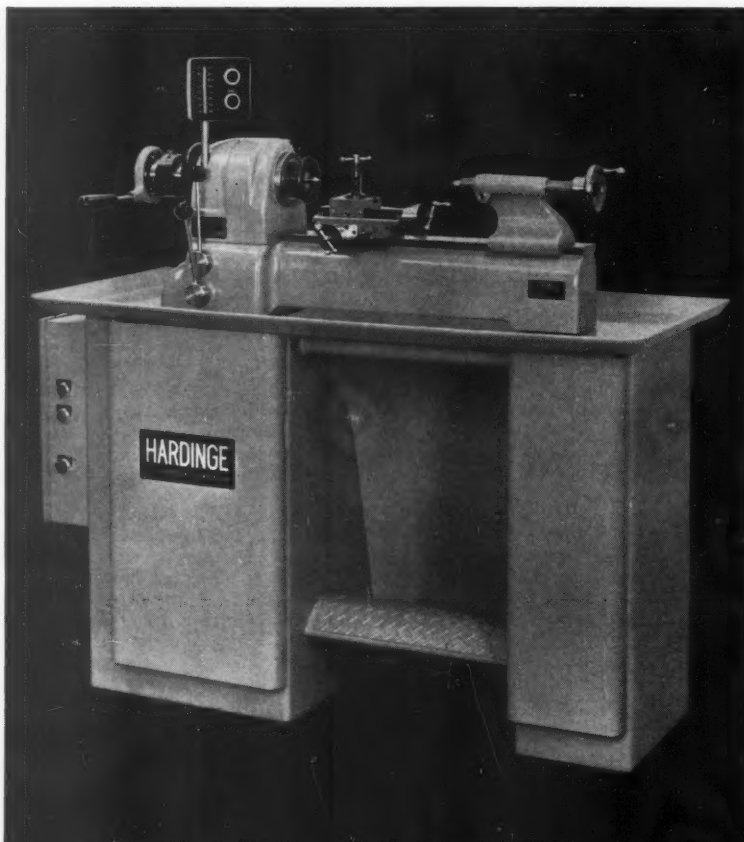


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MACHINERY
JULY 1955

# *Hamburgers and Tomatoes*

EVERY newspaper reader is probably now aware of the fact that the Navy has on hand sufficient canned hamburger to last that branch of the Armed Services for sixty years. This condition exists despite the fact that a Navy manual estimates the keeping life of canned meat at two years. Most of the supply is already unfit for use according to the manual. An unrealistic purchasing program to say the least!

This is only one of the glaring absurdities that occurs when the various branches of a government are permitted to operate without close over-all supervision. It is but one of many disturbing situations that has been unearthed by the Commission on Organization of the Executive Branch of the Government, which is headed by former President Herbert Hoover—conditions which largely developed under the bureaucracies established in time of war and permitted to continue after the emergencies were past.

For example, the Government creates and handles some 25,000,000,000 pieces of paper each year, exclusive of the tons of paper consumed in printing technical manuals, pamphlets, and periodicals. This paper work comprises over 1,000,000,000 individual letters, 9,000,000,000 documents intended for Government permanent records, and 127,000 reports for Federal agencies. The cost of this paper work is $4,000,000,000 annually, and approximates the entire Federal budget prior to 1933. The full-time paper workers of the Government occupy an office space equal to that of thirty-six Empire State buildings.

Federal agencies have assumed the responsibility for the complete or partial health of over 30,000,000 persons at a cost of more than $4,000,000,000 annually. There are a considerable number of Federal hospitals operating in localities where private hospitals offer sufficient accommodations to meet all needs.

In the field of transportation, there are examples of inefficiency and careless disregard for costs. To cite one example, 25,000 pounds of cement were flown to Bermuda in September of last year and over 13,000 pounds of furniture in July. Why the rush? Of the 8,000,000 passengers flown in Department of Defense aircraft, approximately 4,800,000 were hitch hikers or on leave status. The Army sent 807,000 pounds of canned tomatoes from California to New York, while the Navy shipped 775,000 pounds from the East to California. Ludicrous and costly!

These are but a few of the examples of waste and inefficiency in the reports being currently submitted to Congress by the Hoover Commission. In the interests of economy and tax relief, remedial legislation should be enacted without delay. But when people's jobs are at stake, even though they are obviously unnecessary, there is always a hue and cry from job-holders and their friends.

It is, therefore, of primary importance that every person genuinely interested in the welfare of the nation as a whole exert his influence in an effort to have Congress act favorably on the findings of the Hoover Commission. Letters addressed to individual Senators and Congressmen could lead to the saving of $6,000,000,000 through the elimination of waste in Government circles. In addition, approximately $7,000,000,000 in government funds now tied up in capital for wasteful projects could be returned to the Treasury Department for better use.

Charles O. Herb

EDITOR

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# MACHINING DYNAFLOW STATORS

**Close tolerances must be maintained and smooth finishes produced in machining stator-vane carriers for Buick's new variable-pitch Dynaflow transmission. High-speed drilling and boring are employed in producing accurately spaced vane shaft holes along split line between front and rear stator-vane carriers**

**By CHARLES H. WICK**
**Associate Editor**

A REVOLUTIONARY development available on 1955 Buick automobiles is the new variable-pitch Dynaflow transmission which greatly improves performance. The twin turbine Dynaflow with variable-pitch stator vanes alters the performance of the transmission when the pitch is changed. In this sense, the transmission is analogous to the variable-pitch propellers on airplanes. In an airplane, the pilot sets the propeller pitch for increased engine performance during take off or varying flying conditions; while in the car, the driver—by pressing the accelerator to the floor—can change the angle of the twenty vanes in the stator to a high pitch, left in Fig. 1, for fast acceleration either from a standing start or during passing.

Operation is silent and smooth, with no jerks or interruptions of power from the engine to the rear axle. For normal driving, when the operator allows the accelerator to rise from the floor, the stator vanes return to their conventional positions, seen at the right in Fig. 1. Variable-pitch

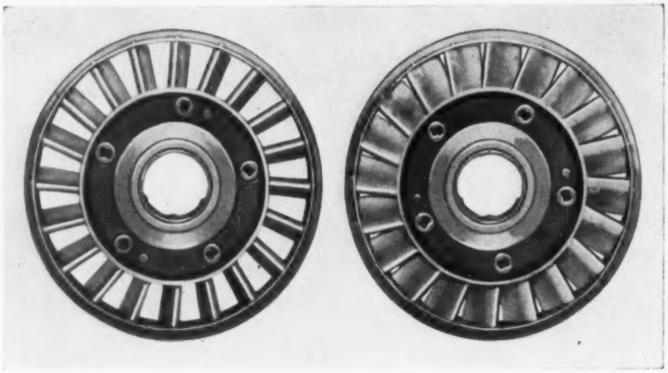


*Fig. 1. Vanes in twin turbine Dynaflow stator are in position seen at left for rapid acceleration, and as shown at right for normal driving.*

Dynaflow, plus an increase in engine horsepower, has cut two seconds from the time required to accelerate from 0 to 60 miles per hour. This improvement in performance, an important safety factor in passing on the highway, is obtained because the high angle of the stator vanes permits the engine speed to increase to a point where the engine will be operating at or near the maximum torque.

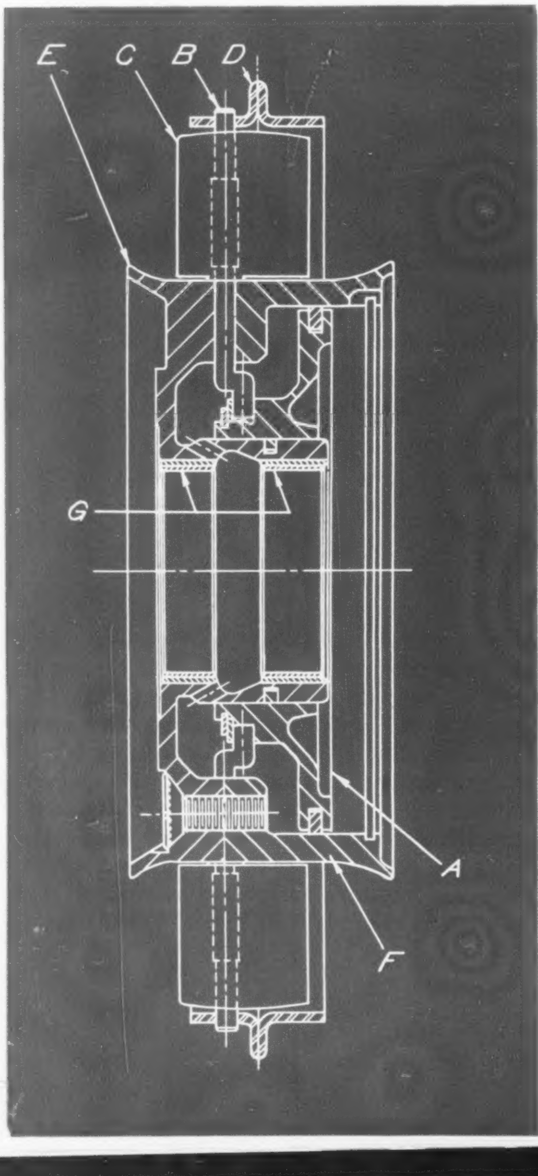



*Fig. 2. Sectional drawing of stator shows cranks (B) mounted in carrier ring (D) and between front and rear carriers (E) and (F). Vanes are seen at (C).*

Change in the pitch of the vanes is accomplished by a hydraulically actuated piston, *A* in Fig. 2, which is controlled by a valve connected to the throttle by linkage. When the piston is moved, it pivots cranks *B*—thus changing the pitch of vanes *C*, which are a press fit on the cranks. The individual crank-mounted vanes can be rotated to change their pitch as much as 75 degrees. The cranks are supported, near their outer tips, by a carrier ring *D*, and between a front carrier *E* and rear carrier *F*. Split construction of the carrier and accurate location of the vane shaft holes along the split line have complicated the manufacture of these parts, but was necessary to permit assembly.

Both front and rear stator-vane carriers are made from cast iron, the parts being cast in shell molds to eliminate the need for rough machining and reduce the amount of stock that must be removed in semifinish and finish machining. Less critical surfaces on the work-pieces are finish-machined in one cut, in which approximately 0.023 inch of stock is removed from the cast surfaces. Where closer tolerances must be maintained, about 0.023 inch of stock is removed in semifinish machining and 0.012 inch more in finishing. An unusual feature of the carrier machining line is that a finish of 70 micro-inches r.m.s. or less is maintained on the hub periphery and piston-bearing surfaces without grinding.

After inspecting the front stator-vane carriers, the shell-mold castings are chamfered, and semifinish-faced (cup side), bored, and turned (large diameter) on Heald single-end, double-head Bore-Matics. Then, similar machines are employed to contour turn the outer periphery of

the carriers, semifinish-face the hub, form an oil-groove in the hub periphery, semifinish-face the split line or mating face, and chamfer both periphery and bore of the hub. For this operation, air-operated expanding mandrels are employed to grip the previously machined casting bores. The duplicate tooling set-ups on one of these machines is shown in Fig. 3. Each set-up has nine tungsten-carbide cutting tools. Cam-actuated slides are used to feed the groove-forming and contour-turning tools. The machines are capable of producing sixty-seven castings per hour.

Single-end, double-head Bore-Matics are also employed to finish-bore the reaction shaft holes in the front stator-vane carriers, maintaining the diameter of the 1 1/4-inch long holes between 1.6265 and 1.6275 inches. The bore and the hub periphery must be concentric within 0.002 inch total indicator reading, and both surfaces must square with the split line face within 0.001 inch per inch. The shell-mold castings are gripped on their hub peripheries by means of Woodworth diaphragm chucks, and solid tungsten-carbide boring bits 5/16 inch in diameter by 1 inch long are used for this precision operation.

A Kingsbury twelve-station, rotary indexing machine, Fig. 4, is employed to drill four equally spaced oil-holes 1/8 inch in diameter in each front stator-vane carrier. The oil-holes extend through the hubs, forming an angle of 30 degrees with the carrier bore. Because of the shallow entry angle and limited space in the bores, it is necessary to start the oil-holes with counter-bores. This is accomplished in the same operation, with end-mills 5/32 inch in diameter mounted on the head spindles at the third, fourth, fifth, and sixth stations.

After burring, washing, and inspecting the front carriers, two steel-backed bronze bushings (*G* in Fig. 2) are pressed into the bore of each carrier by means of the set-up shown in Fig. 5. The Denison 6-ton Multipress is equipped with a six-station rotary indexing table, and two Detroit Power Screwdriver vibratory bowl type, hopper feeding units.

The hopper seen at the top center, feeds a bushing into position above each work-holding fixture as the empty fixtures are indexed to the front of the rotary table. Here, a plunger presses the bushing onto the fixture, and, when the fixture has been indexed counter-clockwise to the next station, the operator places a front stator-vane carrier on top of the bushing and fixture, as shown. As the loaded fixture reaches a position at the rear of the table, a second bushing from the hopper seen at the left slides onto the carrier. Then, the press ram is lowered to push both bushings into the reaction shaft hole of the carrier, one from above and the other from below. When the assemblies are indexed to the next stations, they are manually unloaded and placed in tote pans. The operation is completely automatic except for manual loading and unloading, and occasional refilling of the hoppers. A production of 165 assemblies per hour is obtained.

Both bushings in each front carrier assembly

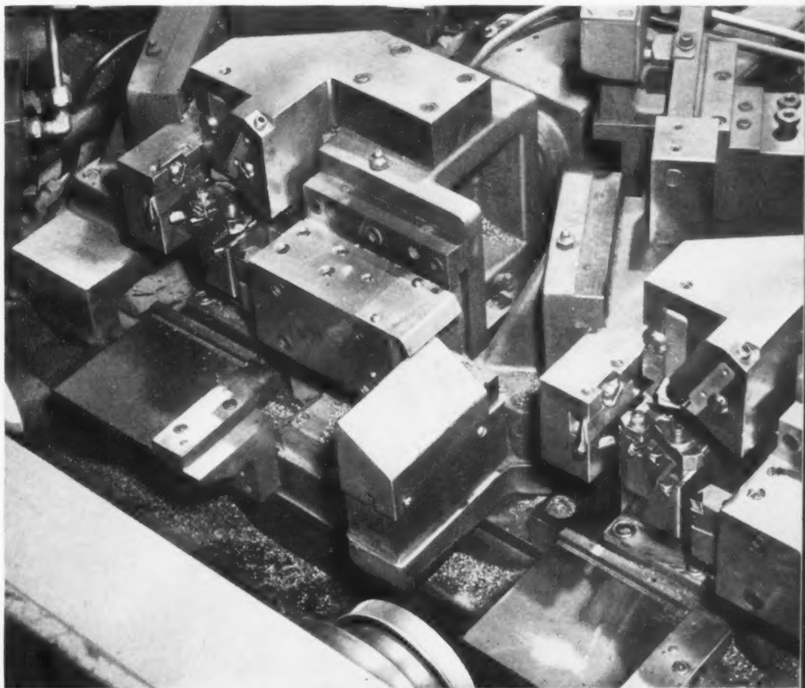


*Fig. 3. Tooling employed on a single-end, double-head machine for contour turning, facing, oil-groove forming, and chamfering vane carriers.*

*Fig. 4. Four angular oil-holes extending through the hub of each vane carrier are counterbored and drilled on this twelve-station rotary indexing machine.*

are semifinish-bored on an Ex-Cell-O precision boring machine, maintaining size between 1.4945 and 1.4955 inches. Then, the thrust and outer faces on the cup sides of the carriers are finish-faced and chamfered, holding the thrust face square with the bushing bores within 0.001 inch per inch. In Fig. 6 is illustrated one of the Heald double-head Bore-Matics employed to finish-turn the hub, and finish-face the hub and the critical mating split-line surface. The work-pieces are gripped on their bushing bores by air-operated expanding arbors. Flatness, squareness, and finish of the surface must be carefully controlled since the mating face must provide an oil-tight metal-to-metal seal. The hub is finish-turned at this time because of the expansion caused in assembling the bushings.

Natco five-station, forty-spindle drilling machines are employed to drill, countersink, and counterbore five equally spaced screw-holes through the flange of each front carrier and bushing assembly. Two parts are carried at each station. At various stations, the work-pieces are loaded, unloaded, and inspected; and the

*Fig. 5. Hopper-fed press for automatically assembling two steel-backed bronze bushings into the reaction shaft hole of each front stator-vane carrier.*

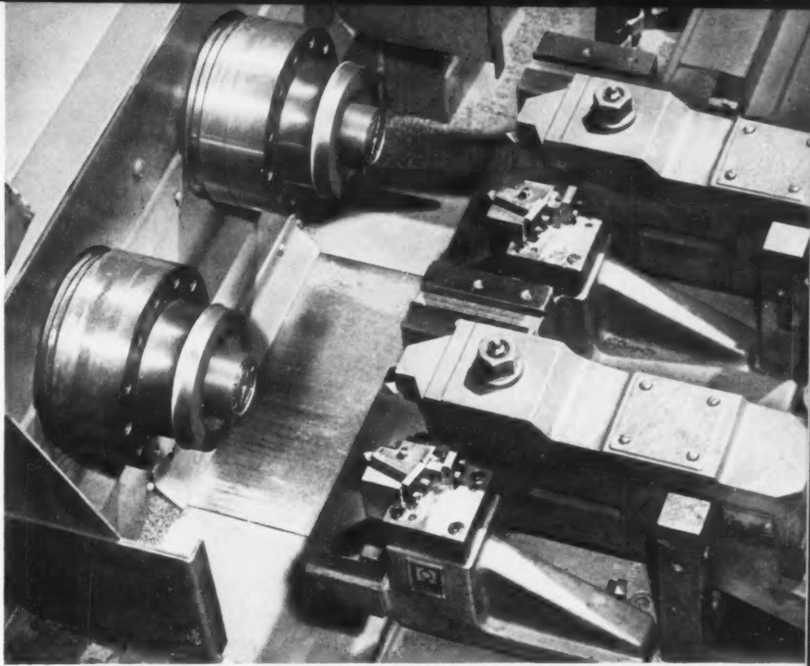


*Fig. 6. Critical mating surfaces on front carrier assemblies are finish-faced, and hubs are finish-turned on this double-head Bore-Matic machine.*

screw-holes are drilled to 17/64 inch diameter, rough-countersunk with special 9/16 inch diameter tools, counterbored to 19/32 inch diameter, and finish-countersunk. The assemblies are then burred, washed, and inspected.

Processing for rear stator-vane carriers, which are also shell-mold iron castings, is similar to that for front carriers. In Fig. 7 is shown one of the Heald Bore-Matics for precision boring and facing the cup sides of the rear carriers. This single-end, double-head machine is equipped with two sets of six tungsten-carbide tools. Each machine completes forty-eight parts castings per hour. The opposite side of the rear carrier is machined flat, square, and smooth to form a mating seal with the front carrier. Natco four-station, thirty-spindle drilling machines are used for drilling, countersinking, and tapping (1/4-20 threads) five screw-holes in each carrier.

After burring, washing, and inspecting the rear carriers, they are assembled to the front carriers. Only four of the five washers and clutch-head screws applied at final assembly are used at this time. The fifth screw-hole in each

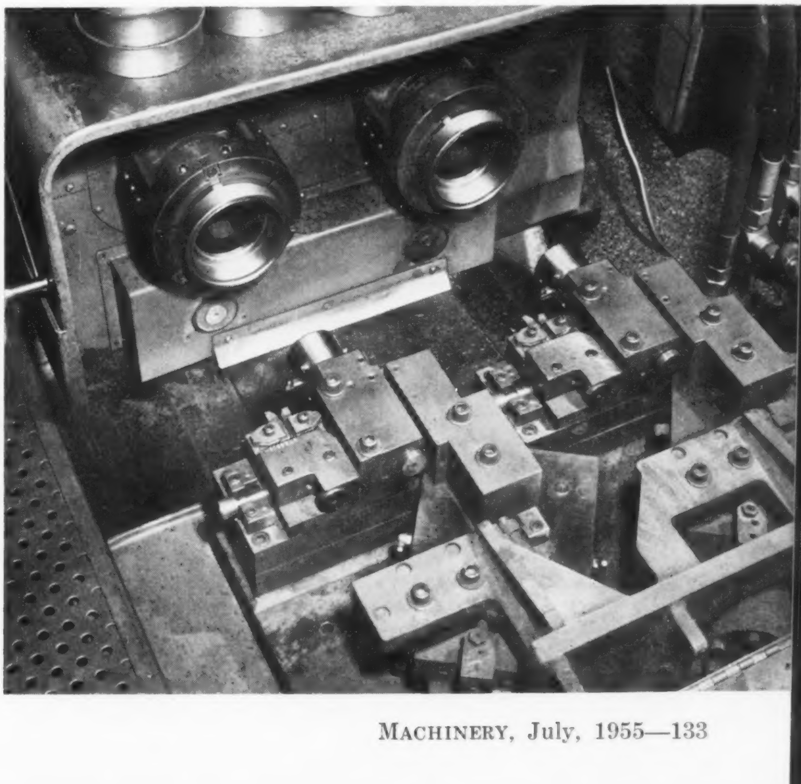


*Fig. 7. Set-up on a single-end, double-head precision boring machine for boring and facing the cup sides of the rear stator-vane carrier castings.*

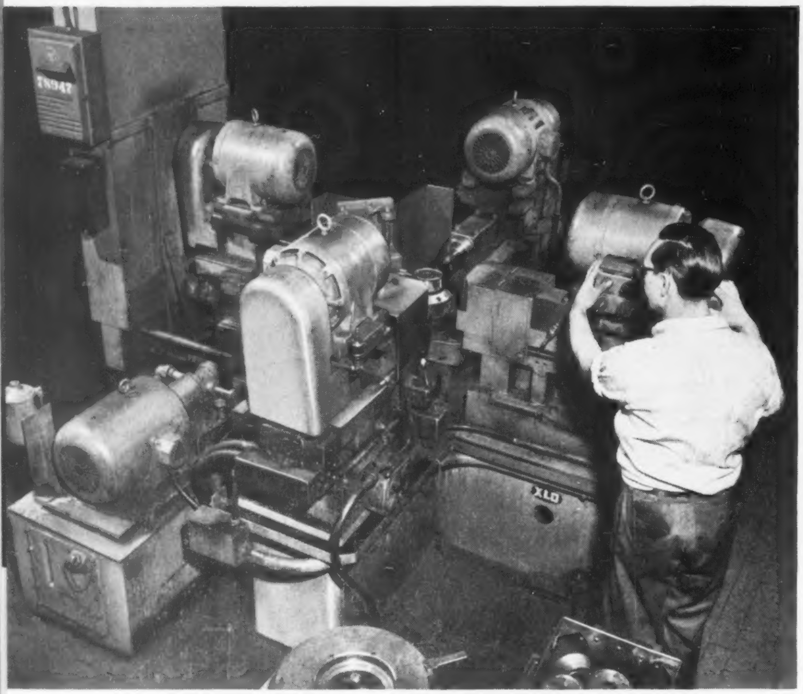


*Fig. 8. Horizontal, four-way, rotary indexing machine of the type employed for drilling and boring vane shaft holes along split line of carrier assembly.*

assembly is used for radial location. A mark is etched across the split line of each assembly by means of an identification stamp to show that the front and rear carriers are a matched pair. Two dowel holes, 0.2460 to 0.2465 inch in diameter, are drilled, burred, and rough- and finish-reamed to press-fit size on a Natco five-station, sixteen-spindle drilling machine. Then, the carriers are disassembled but kept in pairs of matched parts during subsequent processing.

The dowel holes in the rear carriers only, are burred and reamed to provide a slip fit (0.2470 to 0.2475 inch in diameter) to facilitate assembly. Only 0.0005 to 0.0010 inch of stock is removed in sizing the holes without changing their location. This operation is performed on a LeMaire three-station, eight-spindle vertical drilling machine equipped with carbide-tipped reamers in floating holders, and with a floating bushing plate.

Another hopper-fed Denison press is employed to push two dowels into each front carrier. Then, the matched pairs of front and rear carriers are reassembled, with four washers and clutch-head screws being used to assemble each pair. A special large-head screw is mounted in the fifth screw-hole of each assembly for driving purposes and foolproofing (to insure proper location in relation to the dowels). A Kodak optical projector is used to light test the contact between mating surfaces of the front and rear carriers.

The outer surfaces of the assemblies are finish contour turned, and their oil chambers are finish-bored and faced on Heald double-end, four-head Bore-Matics equipped with a cam-operated cross-slide. Identification marks on the peripheries of the matched pairs are remade with etching ink and a numbering stamp. Similar machines are employed to finish the piston bore, finish-face and chamfer the hub end, and cut a snap-ring groove in the piston bore. Also, three half-round cam-driving key slots in the rear carrier are rough- and finish-end-milled.

The assemblies are then tested to detect leaks, with air at 60 pounds per square inch. Switches detect pressure changes. A green lamp signifies acceptable parts, and a red lamp indicates rejects. The rejected parts are immersed in water, and the surface of the water is observed to detect bubbles.

Vane shaft holes in the carrier assembly pass through the split line between front and rear carrier, but they are not actually radial—their center lines being tangent to an imaginary small circle at the center of the assembly. The twenty holes (0.1555 to 0.1575 inch in diameter) must be equally spaced and in the same plane within 0.004 inch, non-cumulative. It was found that these limits could not be maintained when reaming the holes. Now, good results are being obtained by drilling and boring at high cutting speeds and feed rates.

Drilling and boring of the vane shaft holes are done on Ex-Cell-O horizontal, four-way, rotary indexing machines such as the one seen in Fig. 8. Each machine has four spindles, Fig. 9,

which rapidly advance and retract, after which the work-piece is quickly indexed and the spindles advance again. Machining and indexing continue automatically until all twenty holes are completed, with the spindles running continuously. Rigidity of the machine has made it unnecessary to use guide bushings, which would wear quickly at the high speeds employed.

High-speed steel drills, 0.140 inch in diameter by 2 7/16 inches long and having 1-inch long flutes, are employed for the first operation. These drills are precision ground to an included point angle of 80 degrees, and are held in Drewco quick-change collet chucks to facilitate replacement. The carrier assembly is held on an air-operated expanding arbor, and pulled down against rest buttons for locating purposes. Indexing is accomplished with one hydraulic cylinder—a single stroke of the piston in either direction withdrawing a locating pin, indexing the arbor, and inserting another locating pin to complete the cycle.

Initially, the drills were rotated at 4000 R.P.M. and fed at the rate of 0.0008 inch per revolution. However, it has been found that straighter holes and less bellmouth are obtained with a drill speed of 6000 R.P.M. (240 surface feet per minute) and a feed rate of 0.0012 inch per revolution. The drills are replaced after having completed 1000 holes. The cycle time is forty-two seconds for completing twenty holes in each carrier assembly, and each machine has an output of fifty assemblies per hour.

Boring of the vane shaft holes is done on similar machines with solid tungsten-carbide tools. The tools are held in Briney boring heads which are rotated off-center slightly to control size. The single-point boring tools, rotating at 8000 R.P.M. (340 surface feet per minute) and fed at the rate of 0.0008-inch per revolution, remove about 1/64 inch of stock from the hole diameters.

A Kodak contour projector is used to check the radial location of the vane shaft holes, parallelism of the holes with relation to the piston stop face, and angularity of the holes with respect to the center line of the dowel holes. After complete burring of the carrier assemblies, the bushings are finish-bored to size within plus or minus 0.0005 inch. Then the parts are washed and given a final inspection.

Vanes for the variable-pitch Dynaflow transmission stator are made by the AC Spark Plug Division of General Motors Corporation in its Milwaukee, Wis., plant. Aluminum extrusions, 10 to 12 feet in length and of the required airfoil cross-section, are cut into 1.060-inch lengths. Then, holes are drilled, reamed, and counterbored through the vanes and their ends are broached on an Ex-Cell-O transfer machine. Cranks are formed from 0.154-inch diameter wire on Baird automatic wire-forming machines. The cranks are demagnetized, knurled, and assembled in the vanes by means of special AC designed machines.

Final assembly of the variable-pitch stator is accomplished on fixtures which are carried on a

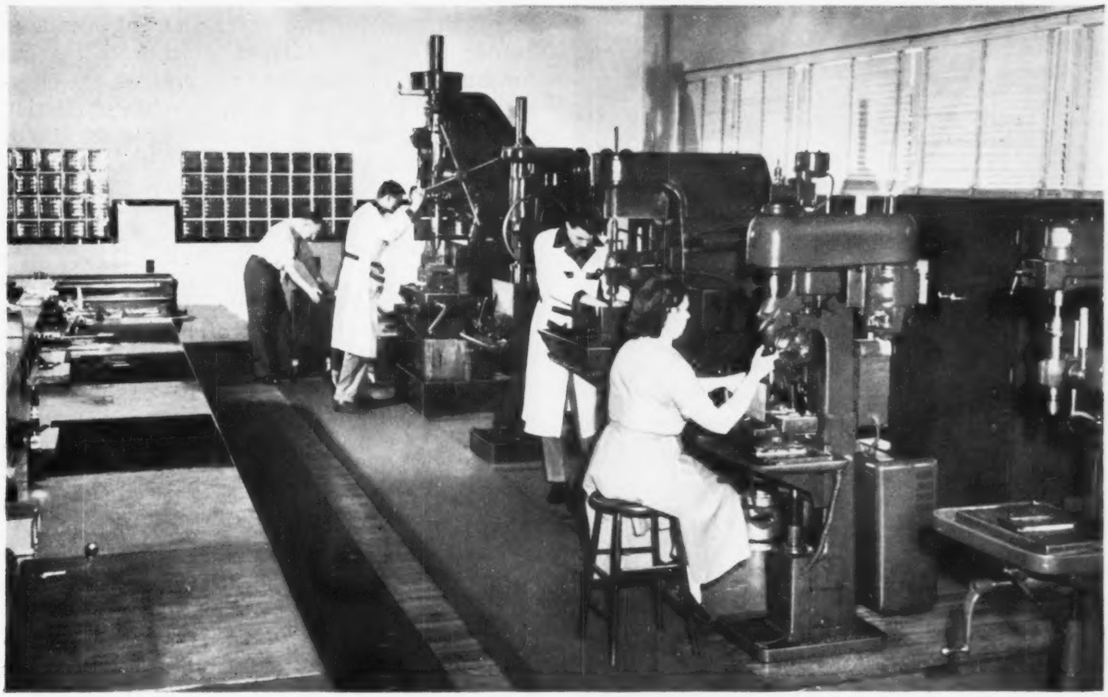
*Fig. 9. Close-up view of machine shown in Fig. 8. Work-piece is automatically indexed after the spindles have rapidly advanced and retracted.*

*Fig. 10. Continuous pallet type conveyor carries fixtures used for final assembly of the stator. Operator is inserting twenty vanes in each stator.*

continuous pallet type conveyor, Fig. 10, making a U-turn at each end of the assembly unit. First, the carrier is disassembled into front and rear components by means of a Keller slip-clutch power wrench, to permit the vanes to be assembled. Then, a sealing ring is mounted on the stator piston, and the piston is inserted.

An outer crank-supporting carrier ring (*D* in Fig. 2) and a rear carrier and stator piston subassembly are placed on each fixture. Then, twenty stator vanes are placed in each assembly, as seen in Fig. 10, the outer ends of the cranks being inserted in holes through the carrier ring, and their inner ends resting on the half-holes in the rear carrier. A retaining ring and snap-ring are applied to each assembly, and a front carrier is pressed into place—employing the hydraulic cylinders seen at the opposite end of the assembly unit in Fig. 11. Finally, five screws are tightened with a power impact wrench to join the front and rear carriers securely. After checking the relative positions and action of the vanes, the variable-pitch stators are ready for assembly of the cams, cam rollers, drive keys, and springs.

*Fig. 11. Opposite end of assembly unit seen in Fig. 10 is provided with hydraulic cylinders for pressing the front carrier into position.*



# Constant Research Insures Better Cutting Tools

Greater accuracy and improved performance have been obtained with the high quality cutting tools resulting from comprehensive and continuous research and development conducted at the extensive laboratories of the National Twist Drill & Tool Co., Rochester, Mich.

By Charles H. Wick
Associate Editor

WELL-EQUIPPED, extensive laboratories, staffed with highly-trained technicians and engineers, are maintained at the National Twist Drill & Tool Co., Rochester, Mich. These facilities are constantly being used for comprehensive research and development work in order to solve customers' problems dealing with cutting tools, establish optimum operating conditions, and—most important—produce improved quality tools that will last longer and give better, more accurate results.

While the benefits from such an elaborate and expensive set-up and program are sometimes difficult to pin-point or justify economically, they are directly reflected in sales and customer satisfaction. Also, more tangible results are often derived. For example, in one case tool life when drilling a tough cobalt-base, high-temperature alloy was increased more than eighty times by shortening the flute length, and in another case a new design heavy-duty drill was developed for tough materials that does not require thinning in sharpening. The latter drill design is covered by a pending patent. In one more instance, a satisfactory tap was developed for threading a hard titanium alloy.

Included in the current projects are basic research studies of drilling action. This long range investigation as to what actually happens at the

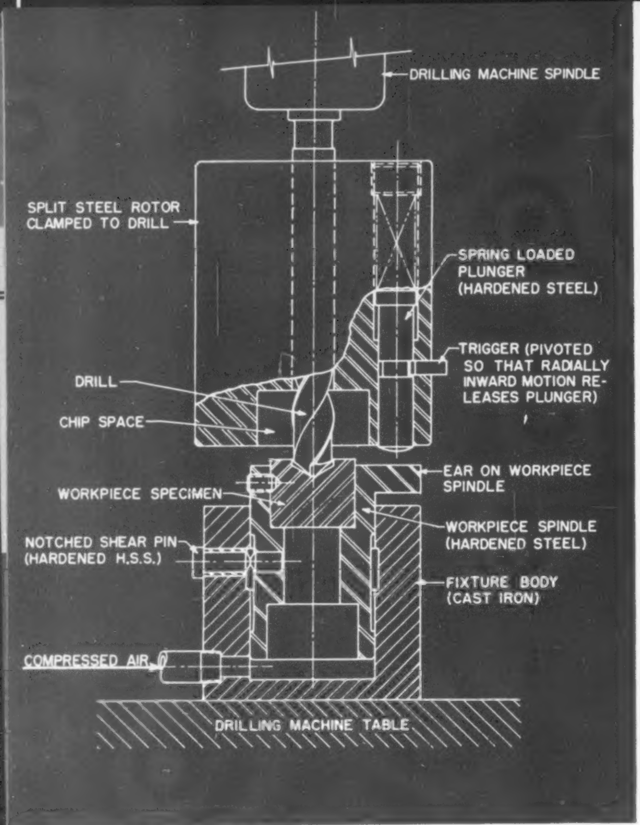



*Fig. 1. Shear-pin deceleration device employed to rapidly stop the relative motion between the drill and work-piece for studying drilling action.*

tool cutting edges and under the chisel edge has been going on for two years and is continuing. Subjects being considered in the studies are fundamental mechanics of the process, the effective rake angle of twist drills, tool life in relation to operating conditions and geometry, the size of holes, and normal variations in twist-drill performance. Other phases are continually being added to the studies.

For such investigations, the physical testing facilities of the Research Department include five drilling machines—four of which can be seen in the heading illustration, and auxiliary equipment. A shear-pin deceleration apparatus, shown diagrammatically in Fig. 1, was developed to rapidly stop the relative motion between the tool and the work-piece, thus permitting examination of chips as they are actually produced during the drilling operation.

This apparatus consists of a rotor (carrying a spring-loaded plunger and a trigger) which is clamped to the drill, and a fixture body which carries the work-piece mounted in a spindle that is held in position by a notched shear pin. A compressed air cushion is maintained under the work-piece spindle to relieve part of the thrust load from the shear pin, and to maintain the work-piece in contact with the drill during the axial-feed motion after the shear pin is broken. During drilling, the trigger is struck, causing the plunger to be released and contact a protruding ear on the work-piece spindle. This breaks the shear pin and immediately accelerates the work-piece spindle to drill speed. After stopping

*Fig. 2. Drilling machine is equipped with a variable-speed drive and a universal recording dynamometer for basic investigations of drill design features.*

the machine, the tool can be screwed out of the hole, leaving the chips attached to the bottom of the hole.

To observe chip formation along the cutting edges, the work-piece specimens are sectioned along planes crossing the chips in the desired direction. The chips are nickel-plated to prevent excessive rounding during metallographic polishing, and the holes in the specimens are molded full of a transparent thermoplastic. As expected, it was found that the chip-formation mechanism along the cutting edges (lips) of the twist drills appears basically the same as for planing, milling, and other metal-cutting operations.

Chip sections taken at smaller radii are similar except for the obvious variations due to changing drill geometry and the lower speeds near the center of the drill. When coolants were used, chips generally were thinner and the character of the built-up edge was changed.

The action which occurs under the chisel edge of the twist drill is quite complex. Sections through work-pieces have shown what appears to be a severe built-up edge acting to make effective cutting rake more positive, and a segmental chip sliding up over the built-up edge. At the very center of the drill, the only tool velocity is that of the feed in the axial direction. Thus, deformation of the metal at the center resembles that caused by an indenting punch. The combined indenting-metal cutting-extrusion under the chisel edge or web portion of the drill yields a highly deformed ribbon chip which eventually escapes into the drill flute.

Geometrical analysis has shown that the effective rake angle of twist drills is positive across the entire length of the cutting edges. Cutting edges near the drill center (not including the chisel edge) produce a shearing cut, and the chip is deflected through a lesser angle than if it flowed normal to the cutting edge as has been commonly assumed.

One of the drilling machines in the physical testing room of the research department is shown in Fig. 2 set up for basic investigations into the influence of various drill design features. This Baker machine is equipped with a Reliance variable-speed drive to permit operation at different speeds. In the illustration, holes are being drilled in a block of S A E 3245 nickel-chromium steel, 6 inches wide by 9 inches long and 2 inches thick, having a Brinell hardness of about 212. A 1/2-inch diameter, fast-spiral twist drill is being used.

Carl J. Oxford, Jr., Research Engineer with the National Twist Drill & Tool Co., is shown at the left adjusting a four-component universal dynamometer designed and build by Shaw, Smith & Associates to National Twist Drill & Tool Co. specifications. This dynamometer, equipped with a Sanborn recorder, is used to measure torque and thrust in drilling or tapping, as well as longitudinal and lateral forces in milling. Also, a recording wattmeter is provided for this as well as all other machines in the department to measure the power input to the motors. Such special tests of regular design twist drills have shown that 50 to 65 per cent of the total thrust force is due

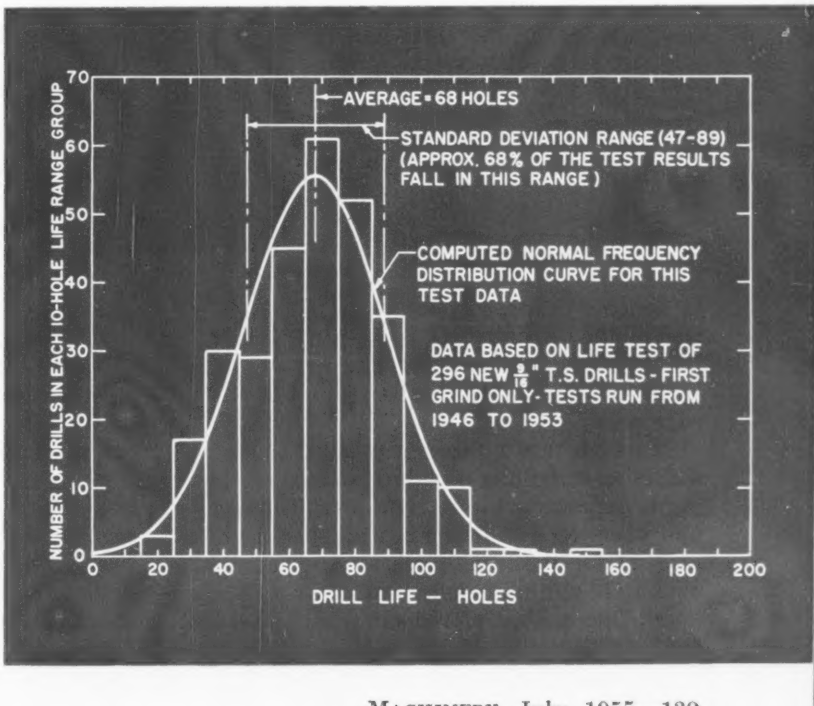



*Fig. 3. Results of testing 296 identical drills, 9/16-inch in diameter, under similar operating conditions showing normal scatter of twist-drill life.*

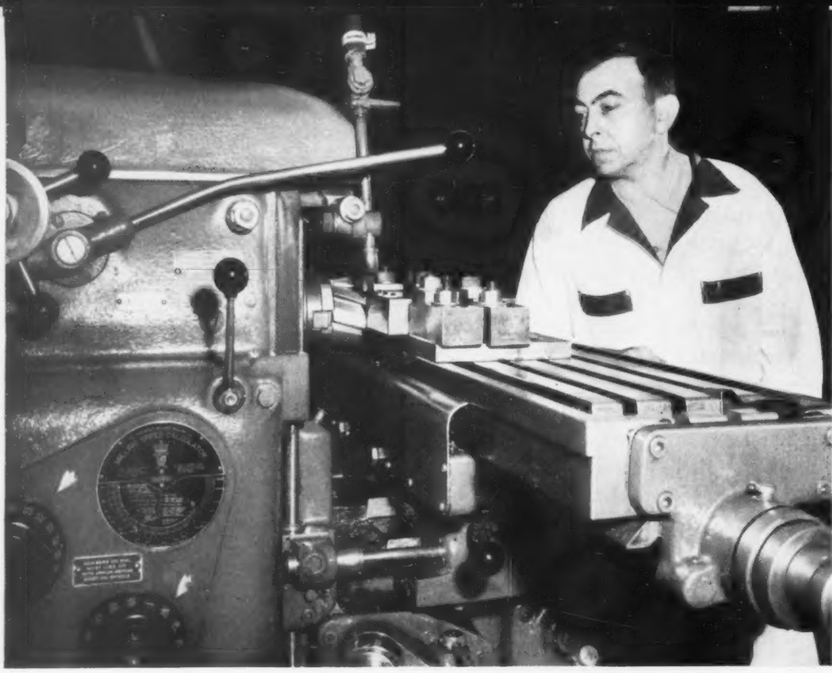


*Fig. 4. (Left) Milling machine set up to determine optimum operating conditions for machining high impact strength, chromium-silicon-manganese steel.*

*Fig. 5. (Right) One of three tapping machines used to investigate relationship of tap drill, size, length of engagement and material strength to strength of threaded assemblies.*

to the chisel edge, despite the fact that this portion of the drill removes less than 3 per cent of the volume of the metal cut, and very little additional power is required because of the chisel edge region.

The high thrust forces can cause appreciable deflection in drilling machines and fixtures, making it imperative to use rigid machines and setups whenever possible. Fixtures should provide support for the work-piece under the point of drilling to minimize deflection in the work-piece itself. One method of reducing drill thrust and machine deflection is the use of split (crankshaft) point drills, which permit cutting conventional chips to almost the center of the hole and reduce the thrust load developed.

Other tests have shown that twist drill life is less sensitive to changes in cutting speed than are turning tools, but feed rates must be within a fairly narrow range for each size drill. However, the best tool life for a given metal removal rate depends upon using the highest possible feed which gives free chip ejection.

Considerable variation has been encountered in the life that can be expected from identical drills, or even between successive sharpenings

of the same drill. This necessitates fairly long research programs involving a large number of drills, and determining an average life value. For example, Fig. 3 shows the results of testing 296 identical drills under similar conditions in the research laboratory. These experiments were made over a seven year period, drilling S A E 3245 steel that had been heat-treated to obtain a Brinell hardness of 228. Average drill life was found to be about sixty-eight holes.

Another important current project in the research laboratories is establishing optimum operating conditions, and determining the most satisfactory tool steels from the standpoints of economy and long life, for machining titanium and high-temperature, high-strength materials. Now, a special alloy steel used for aircraft landing gear and structural members is being tested. This material, having a hardness of 45 to 52 Rockwell C, must be machined in the heat-treated state. It is expected that approximately a ton of this material will be machined before this project—to determine the most suitable tool material for such machinery—is completed.

One of the three milling machines provided in the physical testing facilities is shown in Fig. 4. Here a block of high-impact strength, chromium-silicon-manganese steel is being machined on a Cincinnati No. 2 milling machine. Various speeds, feeds, and coolants, as well as milling cutters made from different materials, are being tried.

In machining titanium alloys, problems were encountered because of the long, curly, and thin chips that are produced. Heat generation is high and concentrated in the small contact area, causing energy dissipation at the tool tip. Because the chip flow velocity is high and titanium has poor thermal properties, the tool-tip temperatures can be very high. Rigidity of the machine, fixture, and cutting tool are important. In general, it has been found that feed rates employed can be about the same as those used for steels. Sometimes, however, feeds may have to be lower than usual to minimize generation of excessive tool temperatures and welding of chips to the tools. Speeds must be changed for the particular titanium alloy to be machined, and may vary from 10 to 300 surface feet per minute.

Every possible precaution is taken to control variables that might influence the results of the tests. If close control is impossible, longer, more comprehensive tests are specified and the results obtained are averaged. To reduce variations that might be introduced by the steel being tested, entire heats of the steel are generally purchased to insure uniformity. Also, the steel may be specially made in an electric furnace to rigid specifications, and the entire heat is then processed and heat-treated at the same time. Tools of known quality are used; operating conditions such as feeds, speeds, and machine condition are closely controlled, and tool sharpening is performed carefully.

Another investigation undertaken by the Research Department was the relationship of tap drill size, length of engagement, and material strength to the strength of screw threaded assemblies. The results of this work were summarized in the article "Tests Establish Strength Factors in Threaded Assemblies," published in the February, 1955, issue of MACHINERY, page 188. One of the three tapping machines employed for such purposes is seen in Fig. 5. This Warner & Swasey precision tapping and threading machine is being used to test a group of taps. Pe-

*Fig. 6. Surface roughness produced in reaming a series of holes is being measured with this instrument having a motor-driven movement for pick-up.*

*Fig. 7. Metallograph (left) is used for microscopic studies of metal structures, and microhardness tester (right) for determining hardness of various samples.*

riodic investigations are made of various sizes of standard taps, drills, and other cutting tools, as well as competitors' products.

The effect of surface finish and condition of both the cutting tool and work are constantly investigated. It has been found that these factors often are responsible for short tool life and high machining costs. Careful attention to the elimination of poor surface conditions can result in considerable savings of time and tools.

A "Surfindicator" made by the Brush Electronics Co. is seen in Fig. 6 being used to measure the surface roughness produced in reaming a series of holes. The instrument is equipped with a motor drive for mechanical movement of the pick-up element along the surface being inspected. Length of the reciprocating stroke is adjustable from 2 7/8 inches to less than 1/16 inch. For inspecting small diameter or long holes, the drilled or reamed specimen block is sectioned as shown to facilitate testing.

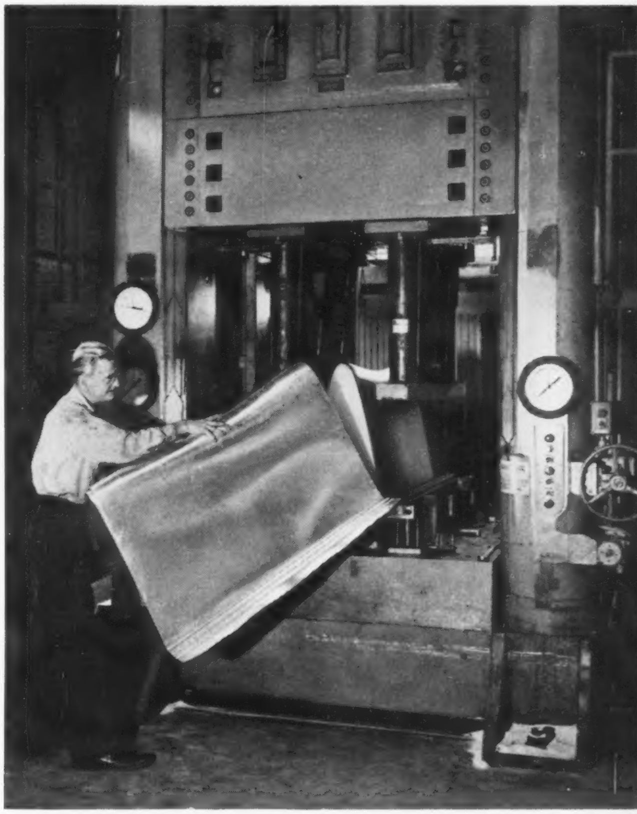
The research facilities also include a chemical laboratory, a general laboratory space, an experimental workroom, and a dark room. Equipment in the chemical laboratory is used for the inspection, analysis, and quality control of raw materials. Each batch of material received is given at least a hardenability test, and, in many cases, a sample from each batch is subjected to a complete chemical analysis. Specifications for special tool steels are frequently developed, giving the requirements for red hardness, resistance to abrasion, toughness, and hardenability.

A Bausch & Lomb Metallograph, seen at the left in Fig. 7, is used for microscopic studies of metal structures from polished and etched specimens. Photomicrographs of the structures can be made with this unit. The Wilson Tukon microhardness tester seen at the right is used to determine the hardness of samples near their surfaces. Also, this tester is frequently employed to check the hardness of different constituents in connection with metallurgical research of various materials.

Additional projects currently under way or recently completed are investigations of portable free-hand drilling of various materials, the fundamental mechanics of tapping, and the drillability of Ductile Iron. An extensive program for the improvement of special nut taps (nib taps) used in high volume production of nuts is under way. For this work a National Machinery Co. bent-shank, automatic, nut-tapping machine is available in the laboratory so that the taps can be tested under production operating conditions.

Development work on gun drilling is also being carried on. The laboratory has available a Pratt & Whitney two-spindle, deep-hole drilling machine, and an Ex-Cell-O precision boring machine. The latter is equipped with a high-pressure coolant feed through the spindle for rotating gun drills. Many more investigations are in the planning stages, and it is felt that much valuable data will be uncovered as a result of the continuing research program.

# Epoxy Dies Used by Convair on Presses and Drop-Hammers



By John F. Crane
Tool Designer
Convair, a Division of
General Dynamics Corporation
San Diego, Calif.

PUNCHES and dies faced with a layer of epoxy resin, or having components made solid from this type of plastic, have been applied within the last year or two by several companies in the aircraft industry. The experience of Convair in using this type of tooling on hydraulic presses and drop-hammers has resulted in appreciable economies and has enabled the production of certain parts satisfactorily in one operation that previously required several operations.

In drawing and forming with epoxy-faced punches or dies, tooling costs have been reduced 50 to 80 per cent, largely because of the time previously consumed in machining the die members to their intricate designs. Plastic tools can be made within two or three days whereas months are needed before machined punches and dies can be delivered by the tool-room.

The making of a plastic-faced die member starts with a model or pattern from which a plaster mold is produced that has a configuration opposite to that required on the die part; that is, convex as opposed to concave, and vice versa. The plaster mold is usually reinforced with hemp or steel and dried in an oven to remove moisture. Two coats of a sanding lacquer sealer are then applied to the cavities of the plaster mold, and next, one or two coats of No. 1020 parting compound. The plaster surfaces are subsequently polished by hand after which plastic parting lacquer is applied. Adequate time is allowed to insure the drying of each coat before the next is applied, or the epoxy resin poured.

Epoxy resin for most die facings and laminations is mixed to the following formula: Epocast 4B2 epoxy resin, 100 parts by weight; Flexibilizer T, 10 to 50 parts by weight; and Hardener HN-951, 8 parts by weight. The Flexibilizer is provided to control the amount of shrinkage and also the final hardness of the plastic face.

The plastic is poured in the liquid state into the prepared mold with a metal backing for the die locked in place. The plastic cures at room temperature to a hard and tough facing that bonds itself to the metal base. The strength of the plastic can be increased by the use of fiber-glass fabric in the plastic mixture.

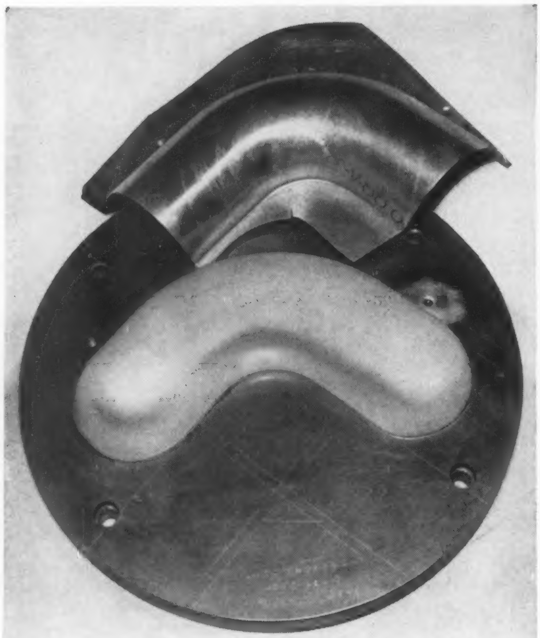


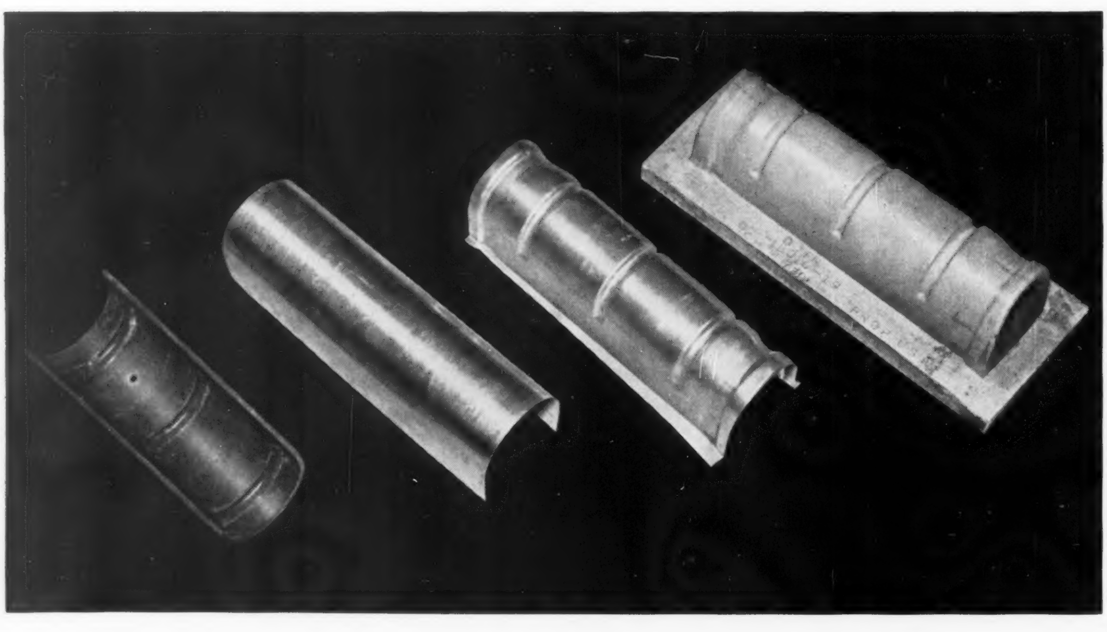
*Fig. 1. Male die member of solid Epocast attached to a steel backing for forming aluminum parts, such as the one shown, under a hydraulic press using rubber pads*

The heading illustration shows an H-P-M triple-action press provided with a narrow plastic die reinforced with a steel baseplate that is used to form the Convair-Liner dorsal-fin leading edge. The material formed is 0.032-inch thick 24S-O aluminum alloy, the piece being formed in two press operations. Steel jaws grooved to prevent material slippage and of a design that enables forming close to the ends of the sheets are attached to the press ram. About 70 per cent of the forming is accomplished in the first operation. The part is then heat-treated in an electric furnace to a temperature of 930 degrees F. Next, a second drawing operation finish-forms the concave leading edge and leaves the material in the T condition. The output with this technique is fifteen pieces per hour.

A male die member made solid from plastic resin for producing aluminum parts without the use of a punch or draw-ring is shown in Fig. 1. This die member is also mounted on a ground steel base.

At the right in Fig. 2 is seen another male die member used in conjunction with rubber pads on a hydraulic press. This die member has an epoxy face. Second from the right is the completely formed part produced with this die member, and next to the left is the work-piece as it appears after having been initially formed to a half cylinder on a press brake or between power rolls. At the extreme left is a laminated plastic shell or template that is placed over the formed

*Fig. 2. (Reading from right to left) An epoxy-faced die member, a formed aluminum-alloy part, an initially formed aluminum part, and a laminated plastic template*



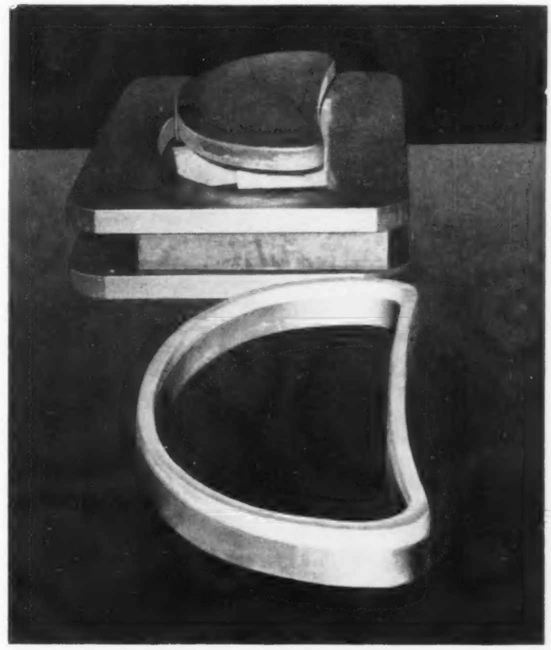


*Fig. 3. In the foreground is shown a semicircular plastic-faced punch that is employed in combination with the steel die and draw-ring seen in the background*

part for scribing the desired edge outline. Later, a trimming operation along the scribed lines is performed on a band saw, router, or some other machine, to complete the piece to specified dimensions.

In the foreground of Fig. 3 is seen a large semicircular punch which has a 1/2-inch thick epoxy face along the top edge. Fig. 4 shows two sets of tools for drawing a sheet-metal part. At the front in each case is an epoxy-faced die and in the middle, an epoxy-faced punch. Above each punch is a steel draw-ring. On these punch and die parts the epoxy face is also 1/2-inch in thickness.

Exact duplication of punch and die parts of this type can be easily accomplished and the plastic faces can be recast as often as required from the original plaster mold.

In Figs. 5 and 6 are outside and inside views of a part produced from 0.051-inch thick 75S-O aluminum alloy under a Chambersburg Cecostamp set-up as illustrated in Fig. 7. The original blank measures 30 by 30 inches. The finished piece has a drawn cavity approximately 20 inches in diameter, somewhat flat on one side, by 4 inches deep.

When this part was formed in two stages with a punch and die of conventional design, there was a high scrappage of parts. Now, with the tools faced with epoxy resin, the part can be successfully drawn in one operation. Light blows are struck in gradually drawing the part, it being the practice to remove, between strokes, several of the rubber pads that are seen above the draw ring.


*Fig. 4. Two sets of dies of somewhat similar type in which the punch and die members are faced with epoxy resin and the draw-rings are made of steel*

*Fig. 5. Aluminum aircraft part with a cavity about 20 inches in diameter by 4 inches deep which is produced under a Cecostamp equipped with a plastic-faced die*


*Fig. 6. Inside of stamping seen in Fig. 5, which was produced from a blank of 0.051-inch thick 75S-O aluminum under a Cecostamp equipped with a plastic-faced die*

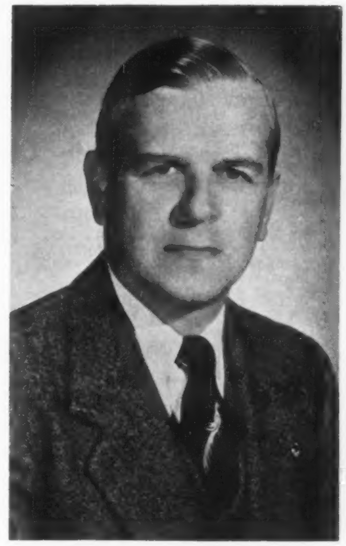
By removing the layers of rubber, one or more at a time, a progressive-stage drawing process is obtained. The pads are 90-Shore rubber, 1/2 inch thick by 2 1/2 inches wide and about 1 1/2 feet in length.

Epoxy resin was cast on the Kirksite punch with the punch positioned 1/2 inch above the die. The plastic used for the die was of the following mixture: Epocast 4CT, 100 parts by weight; Flexibilizer T, 2 parts by weight; and Hardener HN-951, 6 parts by weight. However, because more flexibility was desired in the plastic facing of the punch, the following mixture was used for the punch: Epocast No. 2, 100 parts by weight; Flexibilizer T, 25 parts by weight; and Hardener HN-951, 10 parts by weight.

The draw-ring is solid and was cast from the punch. In this case, the plastic mixture consisted of Epocast 4CT, 100 parts by weight; Flexibilizer T, 14 parts by weight; and Promoter D-2, 3.5 parts by weight. Repairing of the plastic dies can be accomplished with a resin accelerator. The surfaces of the dies must first be cleaned and roughened. All plastic materials were supplied by Furane Plastics, Inc., Los Angeles, Calif.

*Fig. 7. Cecostamp equipped with epoxy-faced die members for producing the aluminum-alloy part illustrated in Figs. 5 and 6*

# From Thousandths to Millionths



## *Machine Tool Show to Stress Accuracy*

By Louis Polk, President
Sheffield Corporation, Dayton, Ohio, and
First Vice-President and Director
National Machine Tool Builders' Association
Cleveland, Ohio

THE visitor to the forthcoming Machine Tool Show will be most forcibly impressed by greater emphasis upon extreme accuracy, the controls designed to assure it, and the remarkable new devices for its measurement. The United States Government lists some 441 different types of machine tools, not counting various sizes and combinations. Most of these will be on exhibit at the Show to be held in the International Amphitheatre in Chicago, Ill., September 6 to 17. Over 150 companies will have the latest models on display at the largest exhibit of machine tools ever held under one roof.

In conjunction with the Machine Tool Show, there will be a Production Engineering Show held on the Navy Pier for the exhibit of mechanisms, instruments, and equipment that contribute to greater production. Throughout both these shows will run the recurring theme of greater precision to meet the growing demand for the narrowing of tolerances. This is of vital value to product performance, and thus stimulates our national economic abundance. It is by the achievement of greater accuracy in the shaping and forming of metal that we have developed and extended fields of manufacture beyond anything dreamed of in past years.

### *Growth of Many Industries Based on Narrowing of Tolerances*

Consider the households and vehicles of twenty-five years ago. In that period some homes had mechanical refrigerators, one of the first popular appliances in which parts had to be produced to tolerances of less than one-thousandth of an inch. The proportion of homes of a quarter century ago that had refrigerators compared to the same ratio today would be a small fraction. In 1950, 80.1 per cent of American homes had them, whereas just ten years before only 44.1 per cent had this now essential appliance, according to the U. S. Census. Thus, a narrowing trend in tolerances made possible an industry that could provide these appliances for over 18,000,000 homes in the decade that included World War II. The birth of this industry approximates that of modern measuring comparators, which can amplify dimensional variations 1000, 2000, 5000 or 10,000 times and more.

In the automotive industry of a quarter century ago, we had arrived at a position of good mass production for mass demand. Then there was speculation of market saturation. Yet today we have attained heights in automotive production beyond the predictions of the most optimistic dreamers of the past. Today, cars are produced with clearances controlled to tenths of thousandths of an inch. Twenty-five years ago, these clearances were subject to variations in thousandths of an inch. In those days some purchasers who did not observe the required initial break-in speeds suffered the expense of engine seizure. Others, whose cars were delivered with clearances on the loose side of the large tolerances, suffered the expense of high oil consumption and early engine overhaul. Certainly the narrowing of tolerances can take its im-

portant position along with styling, engineering, fuels, materials, and lubricant improvements as a major factor in the continuing development of increasing automotive demand.

Our giant aircraft industry—recently accorded the number one position in terms of national production dollars—is based on mass production with tolerances of tenths of thousandths of an inch. Some aircraft components must be mass produced to tolerances of millionths of an inch. Where would we be in today's military situation if the constantly increasing precision capabilities of our machine tool and gage industries had become static or laggard?

### *Philosophy of Manufacturing Tolerances*

A few fundamental facts will help us to understand the philosophy of tolerances in manufacture. A tolerance is a permitted variation in the size of a part. It is, of course, a compromise with perfection—a recognition of imperfection in man and machine. Every tolerance should have a history beginning with the first prototype in development and ending with the last piece of the mass production schedule. Sometimes the tolerance is, unfortunately, a mistaken guess and not the desired mature decision related to its import on production, capability, economy, product functioning, and service life. Sales activities that gage quality in relation to consumer demand can provide vital information for tolerances. Manufacturing operations continuously develop tolerance information that can be fed back into the drawings for product quality improvement and cost reduction—the all-important elements of the realistic reappraisal that becomes a tolerance.

Like every human endeavor, there are some undesirable practices in the science of applying tolerances to dimensions for manufacture. One is the occasional practice of selecting as a locating point for machining or gaging an intangible, unreachable, imaginary point in space that for all practical purposes can be used by the adroit to prove anything or nothing. Locating points should be definite and tangible, touchable and seeable, and the same one should be used throughout successive machining operations to maintain proper relationships.

Another offensive and costly delinquency is neglect in establishing and maintaining the same locating features for both machining and gaging. Only infrequently is this impossible, and then alternates must be selected with extreme care. Still another is tolerance withholding—due occasionally to the lack of faith in, or ignorance of, inspection discipline—which results in placing on the drawings only a part of the tolerances that will assure quality and cost objectives.

Sometimes tolerances are restricted by early uncertainties about product functioning or production capabilities. These uncertainties should be resolved as early as possible in the production run, and their resolution should unleash a flow of information for tolerance liberalization. This advocacy of liberalization may seem inconsistent with the subject of narrowing tolerances, and it should be emphasized that we are discussing here the trend contributing to the development of products which extend the markets of mass demand and military might.

Our daily production dogma should be: (1) the most liberal tolerances consistent with quality, interchangeability, performance, and cost objectives; (2) the assurance that such tolerances are placed on the drawings complete and without ambiguity; and (3) that production be guaranteed the full benefit of these tolerances by being provided with the best in machine tools, and gaging and measuring instruments of compatible precision, used under the most efficient operating and inspection practices.

### *Close Tolerances Can be Maintained Economically*

Narrowing of tolerances need not mean higher costs or difficulties in manufacturing. For example, the increasing precision of gages and measuring instruments permits our ever improving machine tools to produce more accurately. Going back a quarter of a century to the beginning of our modern high-precision shop and laboratory measuring devices, the product designer then had to envision a "tithing" (10 per cent) of the tolerance on each limit of a dimension for fixed gage tolerances. This system could, under some circumstances, operate to deprive production of 20 per cent of permitted variation.

A wear allowance on the "Go" gage, or the maintaining of a manufacturing gaging system within a final acceptance inspection gaging system, could then result in further tolerance tithing and compounding. A narrowing of gage tolerances has resulted from the precision advances in gage manufacture, and the development of instrument gages that split the old tithing concept into fractions. This enables production to utilize almost 99.44 per cent of the drawing tolerance.

Another concept for broadening production tolerances is the field dealing with classification gages that segregate parts to size classifications within a tolerance. To assure required clearances for lubrication or gas leakage limits, as well as other functioning requirements, the designer

establishes allowances—intentional size differences between mating parts. Classification gaging provides the means for limiting the clearance variation to very close limits without placing costly close tolerances on the over-all individual manufacturing tolerances, such as the diameter of piston-pin holes and the diameter of piston-pins, whose difference determines the clearance. Thus, economy of manufacturing piston-pins to thousandths can be secured, but they can be classified and assembled to tenths of thousandths with matchless improvement in performance.

This system requires selective assembly of the segregated parts, but on some items of mass production such size matching in assembly is but a fraction of the cost of machining to the close tolerances that would be necessary to attain the same quality of fit on a basis of universal dimensional interchangeability. Such selective assembly after segregation by size classification gaging in certain products has actually improved functioning, increased customer acceptance, and proved to be no hindrance to maintenance.

### *Precision Requires Extreme Vigil*

The precision advances that enable tolerance narrowing for the development of new products and improvement of old products are not of a singular nature. They extend from our National Standard of Length in Washington to the machine tool on the shop floor. As we ascend the ladder of precision control, the steps become more and more restrictive. The gage or measuring instrument built into the machine tool or used by its operator must be accurate to better than 10 per cent of the tolerance it controls. The maker of the gage must control his standards to better than 10 per cent of the product he sells. The standards laboratory that provides gage-block standards to gage-makers again must maintain a control that is better than 10 per cent of the precision in his outgoing product. Arriving at the final step, our National Standard of Length, this tithing of precision leads to the seventh decimal place—one-tenth of one-millionth of an inch—in precision requirements.

Vigilance to maintain our national production potential demands that we exercise continual surveillance on all echelons of our precision structure that guard the integrity of production tolerances. The horizon for future advances reveals that the partnership of the machine tool and measuring means must continue on an even more integrated basis—such as built-in gaging, automatic control, or feedback for tool correction and adjustment—with the narrowing of tolerances for the development of new and improved products marketable for mass demand.

The remarkable technological advances made in this direction will all be on display at the Machine Tool Show in Chicago. It will have the appearance of a giant machine shop, with nothing to obstruct the view except the machines themselves. Practically all of the machines will be in operation.

Visitors to the Show will consist chiefly of top executives of manufacturing companies, vice-presidents in charge of operation, plant managers, engineers, designers, men engaged in research and product development, production experts, and financial executives concerned with problems of cost reduction. It is estimated that at least 200,000 men in these classifications will attend the Show to see and compare the various makes and types of machines that may be appropriate for replacement requirements.

In this connection a primary question is bound to be, "Will my plant be ready for the tolerances required tomorrow?" For the trend is from the thousandths to the millionths. Man's industrial progress is based upon his ability to divide, even finer, the meter and the inch.

* * *

## M.I.T. Offers Course in Numerical Control of Machine Tools

To assist in meeting the demand for technical information in the field of automatic control, a two-week Special Summer Program in "Numerical Control of Machine Tools" will be presented by the Massachusetts Institute of Technology from August 22 through September 2, during the 1955 Summer Session.

The program is designed especially for engineers contemplating the application and use of such equipment. Lecture topics will include: principles of information—processing as applied to the use of machine tools; numerical control systems and their machine tool applications; equipment design for numerical control systems; and design considerations for system reliability.

Afternoon sessions will be devoted to programming techniques and will include such topics as mathematics of programming, practical procedures, and machine aids. The group will prepare a program for machining a work-piece and actually execute the operation.

The number of registrants is limited, and preference will be given to applicants now engaged in the design or application of automatic machine tool equipment, or anticipating entrance into this field. Full details for this Special Summer Program may be obtained from the Summer Session Office, Room 7-103, Massachusetts Institute of Technology, Cambridge 39, Mass.

# Milling with Carbide Can be

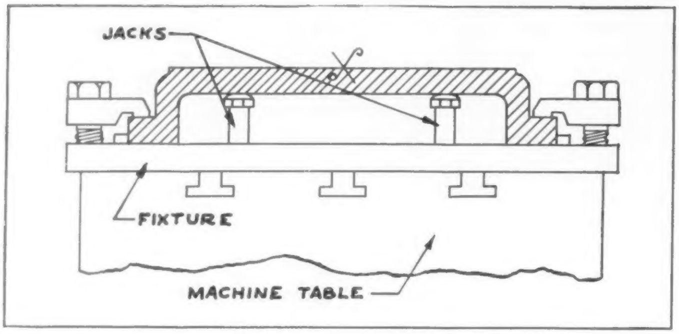



**Fig. 9. Jacks must be placed under any large unsupported areas to assure the rigidity necessary to withstand the high metal removal rates encountered with carbide milling cutters.**

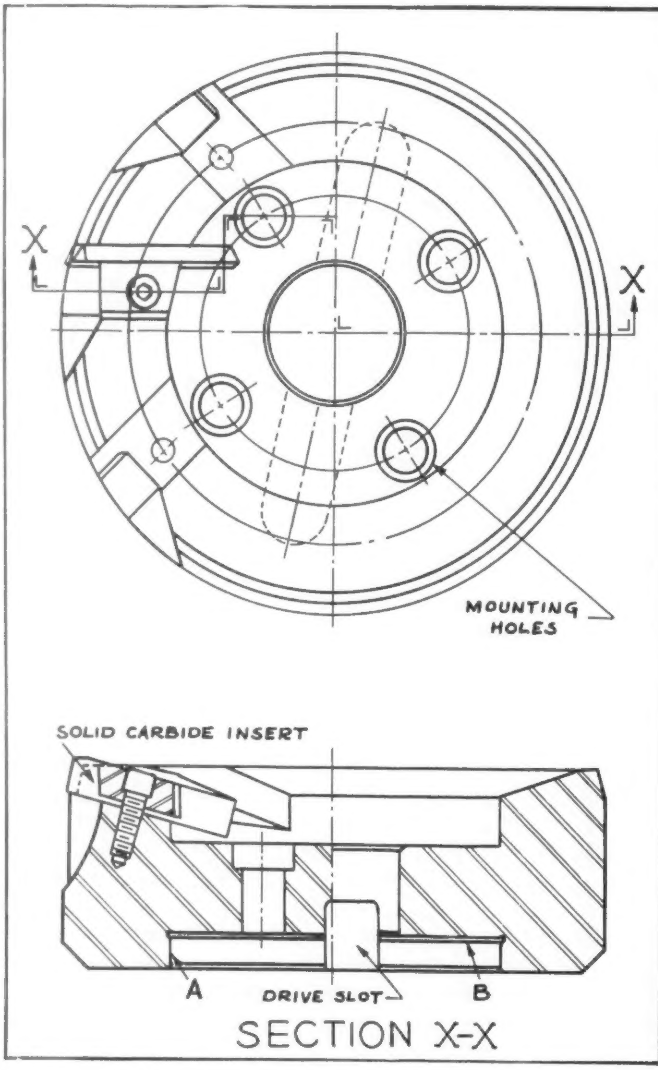



**Fig. 10. Surfaces denoted by letters (A) and (B), section X-X, are the critical mounting surfaces against which the machine spindle banks. Close tolerances are maintained on diameter (A).**

SELECTION of the carbide milling cutter, condition of the milling machine, design of the work-piece, and training of the operator are the four basic factors upon which rest the practicability of milling with carbide. These points were treated in some detail in the first installment of this article published in May MACHINERY, page 161. Machine set-up and operation, cutter wearing characteristics, and carbide trouble-shooting are the subjects considered in this concluding installment.

The importance of work-piece clamping cannot be stressed too greatly. Fixtures should be of rugged construction to permit maximum metal removal per pass without the danger of work-piece deflection. Positive stops, or locating devices, must position the work-piece in its proper relation to both the cutter and the direction of feed.

Sufficient means of clamping should be provided to hold the part firmly in the fixture, if one is used, or on the machine table if no fixture is required. If the work-piece is frail, or if there are large unsupported areas, additional jacks must be placed so that the part is held rigidly and is free from torsional and bending strains, Fig. 9. It is also important that the surface to be milled be kept as close as possible to the machine table, mostly to avoid excessive wear or chipping of the cutter blades, and also to prevent chatter marks on the part.

### *Cutter Mounting on C-Arbor*

Proper cutter mounting on the machine spindle is essential to good tool life. The diameter of the locating face on the end of the spindle should be as close as possible to the

# Profitable

By Douglas C. Cunningham
Mid-Atlantic States District Manager
Kennametal, Inc., Latrobe, Pa.

**Second of two installments dealing with the essential factors leading to the realization of profitable carbide milling**

cutter mounting-face diameter, and never under one-half that of the cutter. Run-out or eccentricity can have a detrimental effect on the cutting edge, and should therefore be held to a maximum total indicator reading of 0.0005 inch on the face, and of 0.001 inch on the outside diameter with cutters under 8 inches in diameter. With cutters over 8 inches in diameter, the allowances can be permitted to run as high as 0.001-inch total indicator reading on the face run-out, and 0.004-inch total indicator reading on the outside diameter. In Fig. 10 is seen the cross-section of a typical cutter with the critical mounting surfaces noted by the letters *A* and *B*.

Several conventional methods of mounting the cutter may be used, depending on whether it is provided with a counterbore or is of the "flat back" type. A C-arbor, or stub arbor as it is commonly called, Fig. 11, should be used with the cutters that do not have a counterbored back face. Arbor *C* is locked within machine spindle *D* by means of a draw-bar. Cutter *E* is located over the nose end of the arbor and is held firmly against the spindle face by lock-screw *F*.

The same arbor can be used, if desired, with a counterbored cutter. In this case, the counterbore slips over the spindle end while the nose of the arbor merely fits within the center bore of the cutter to serve as a support during mounting. The lock-screw is not used. A multiple bolt arrangement, usually consisting of four bolts, locks the cutter to spindle. In either type mounting, drive lugs, or keys, which are permanently fastened to the spindle face, fit into mating slots in the rear cutter face to provide positive drive.

### *Cutter Positioning and Horsepower Requirements for Face-Milling*

In face-milling, the relative position of the cutter to the work-piece must be considered. Optimum cutter performance and maximum cutter life will be realized, especially with carbide face mills, if an entrance angle somewhere between 30 and 90 degrees is obtained, as is the case at *a* in the set-up shown at X in Fig. 12. Under these conditions, initial contact of the cutting edge with the work-piece yields a chip thickness close to the desired maximum chip thickness that is generated in the path of the milling cutter center line. A solution to the common problem that arises when the milling

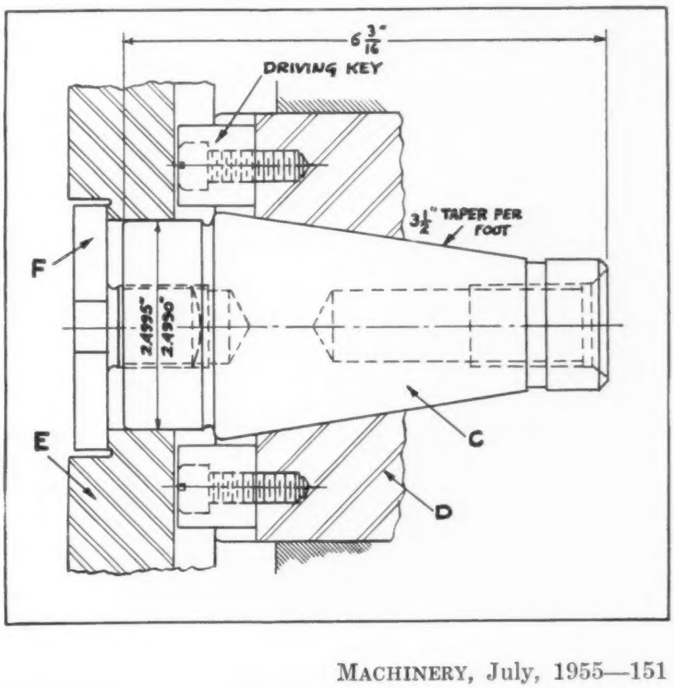



Fig. 11. A stub, or C-arbor, tapered to fit in the machine spindle, is used to mount "flat back" type cutter bodies. Lock-screw (F) holds the cutter in place.

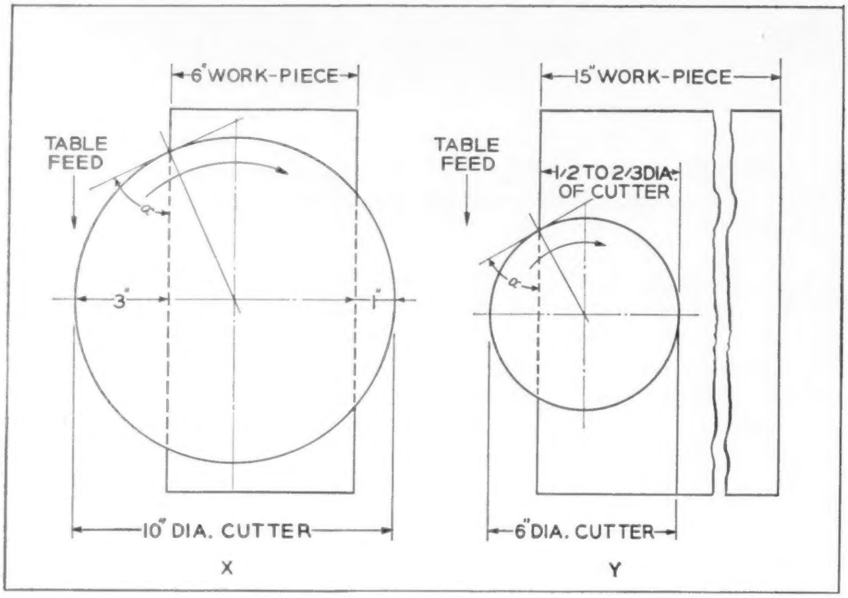



Fig. 12. Relative position of the cutter and work-piece, and also the direction of rotation and feed are important. The entrance angle of the blades should be held between 30 and 90 degrees.

cutter is much smaller than the width of the surface being cut is seen at Y. Several passes are made with the tool taking a cut that ranges in width from one-half to two-thirds of the cutter diameter. Proper entrance angles are thus maintained during each pass.

In determining the number of cuts, or passes, required to complete a particular job, several factors must be considered. Two of these are the depth-of-cut capacity of the cutter and the available chip clearance. Naturally, the cut can be no deeper than the length of the sharp cutting edge. Even this depth hinges on the availability of adequate chip clearance to avoid piling up or jamming of the chips. Either of these two conditions is likely to cause cutter failure in addition to serious effects on the milling machine and holding fixture, and a damaged or scrapped work-piece.

Limits of available horsepower will also influence maximum permissible depths of cut. A satisfactory formula for calculating required horsepower for milling alloy steel is as follows: 1 H.P. at the cutter per cubic inch of metal removed per minute. In the majority of cases, an allowance of 20 to 30 per cent will compensate for power loss in the machine.

For example, a 1/2-inch thick layer of steel is to be removed from a rectangular surface 6 inches wide by 10 inches long. Under the supposition that a 10-inch diameter, ten-tooth, universal face mill is to be employed, a cutter speed of approximately 150 R.P.M., or 450 surface feet per minute, with a 0.015-inch chip load would be used. This would result in a table feed rate of slightly more than 20 inches per minute. If the full 1/2 inch of material were to be removed in one pass, 60 H.P. would be required at the cutter and an additional 20 per cent to compensate for machine losses, or a total of 72 H.P. This is determined by applying the short formula for calculating required horsepower.

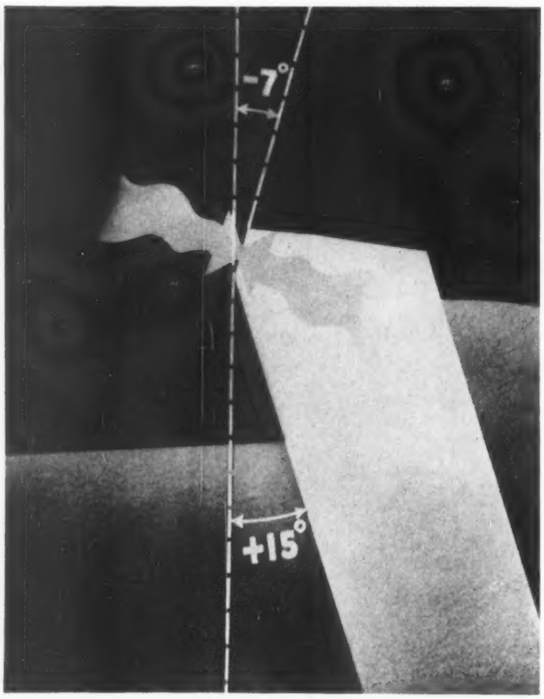



Fig. 13. Cutter-body positions inserted blade at a positive radial rake angle of 15 degrees. The 7-degree negative lead angle aids in absorbing the entrance shock of the cutter blade in the work.

On the other hand, if only 50 H.P. were available, there are two simple corrections that would solve the problem—either remove the stock in two equal passes, or remove every second blade from the cutter body and cut the table feed rate in half. It should be noted that the required horsepower formula for milling alloy steel can be applied to mild steels, cast irons, and soft alloys by substituting 0.7, 0.5, and 0.2 or 0.3 H.P., respectively. General speed and feed recommendations found in the operator manuals supplied by the carbide milling cutter manufacturers should be followed.

### *Operating Characteristics of Inserted-Carbide Blades*

Operation of the cutter naturally results in blade wear which, in itself, can be an accurate measure of how well the factors of carbide milling have been combined. Normal edge wear, or loss of peripheral clearance, can be considered as a wear land two or three times greater than the chip load per tooth. For example, if the feed is calculated to be 0.010 inch per tooth, then 1/32-inch edge wear would be normal. This would be accompanied by a slight indication of cratering (top wear) when milling steel, but little or no such evidence when milling cast iron.

Abnormal wear can be due to any one, or a combination, of three factors: improper selection of speed, feed, or carbide grade. Excessive edge wear is the result of too high a cutter speed, too light a feed, or the use of a carbide grade having insufficient resistance to abrasion. Field experience usually proves one of these three reasons to be the cause, and usually in the stated order. Excessive cratering, which is uncommon in average carbide milling, is the result of the cutter speed being too slow, the feed too heavy, or the use of a carbide grade having insufficient crater resistance.

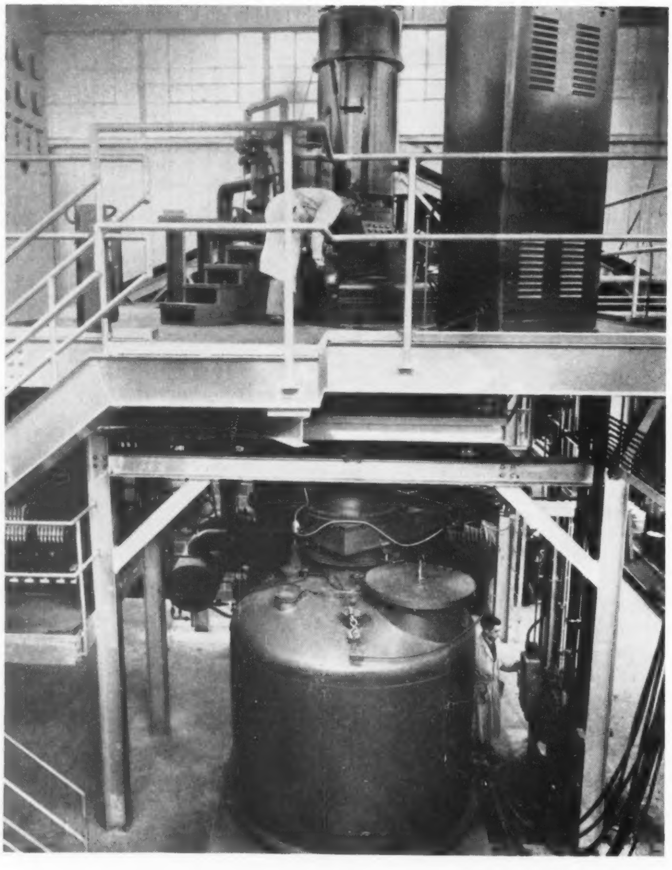
**Trouble-Shooting Check List for Carbide Milling**

| Trouble | Probable Causes |
|---|---|
| **Excessive Edge Wear** | 1. Speed too fast<br>2. Feed too light<br>3. Incorrect grade of carbide<br>4. Nose radius or corner angle too large<br>5. Improper grinding (minute heat-checks, flaked edges) |
| **Excessive Crater** | 1. Speed too slow<br>2. Feed too heavy<br>3. Incorrect grade of carbide |
| **Chipping** | 1. Grinding heat-checks<br>2. Lack of honing<br>3. Insufficient chip clearance<br>4. Nose radius too small<br>5. Corner angle too small<br>6. Saw-tooth edge due to coarse grinding wheels<br>7. Chatter in machine spindle<br>8. Face run-out due to improper mounting in either cutter grinder or milling machine<br>9. Incorrect grade of carbide (too brittle)<br>10. Weak cutting edge due to too much radial clearance or radial rake<br>11. Insufficient rigidity in set-up of job<br>12. Entrance angle too small (causing radial pressure in wrong direction on cutting edge)<br>13. Cutter diameter too large for spindle<br>14. Chatter due to excessive overhang of machine spindle<br>15. Cutting pressure against fixture clamps<br>16. Careless handling of cutters |
| **Cracking or Breaking** | 1. Feed too heavy<br>2. Using cutter with chipped or worn edges<br>3. Thermal shock from improperly applied carbide<br>4. Speed too slow (build-up on blade prior to breaking)<br>5. Depth of cut exceeding length of cutting edges<br>6. Cracks resulting from excessive brazing strains<br>7. Loss of normal grade strength due to brazing<br>8. Ignoring all points listed under "Chipping" until they exceed normal strength of the carbide |
| **Chatter Finish** | 1. Insufficient rakes or clearances<br>2. Insufficient horsepower at cutter<br>3. Nose radius or corner angle too large<br>4. Excessive overhang of cutter or work-piece<br>5. Only one tooth cutting at a time<br>6. Lack of rigidity in set-up (especially if climb-cutting) |
| **Torn Finish** | 1. Speed too slow<br>2. Dull blades<br>3. Improper grinding |
| **Glazed Finish** | 1. Dull blades<br>2. Insufficient "dish" angle<br>3. Feed too light<br>4. Excessive honing |

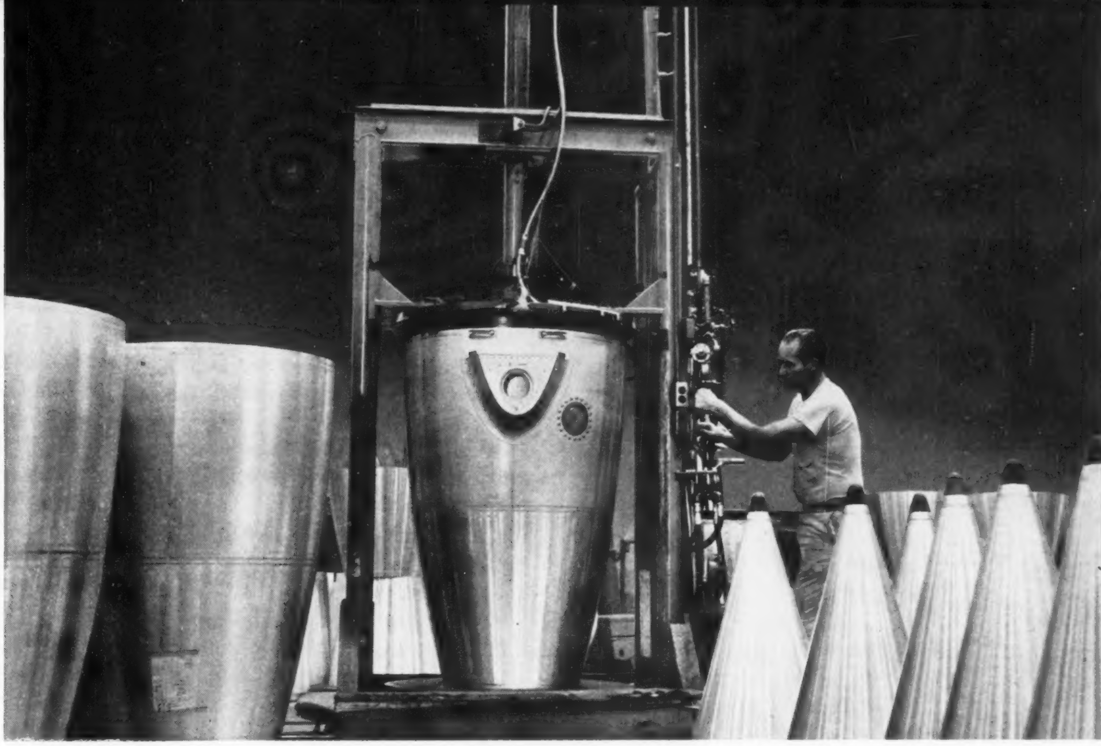
Excessive chipping or breaking of carbide cutter blades is undoubtedly the most serious, and by far the most common, condition. When considering general cutter design, a corner, or lead angle, is desirable to protect the critical nose radius by absorbing the entrance shock on the part of the cutting edge best suited for it. The angular edge also spreads a thinner chip over a wider area of the blade, avoiding concentration of chip pressures in a small area. The nose radius, which is important for good edge life, should be approximately one and one-half times greater than the chip load per tooth. If no facilities are available for grinding such a radius, a chamfer can be used. This chamfer should follow the same proportions that would be applied in the case of a radius.

Rake angles (radial rake, axial rake, and their resultant "true" rake) should be positive, provided that chipping or edge breakdown is avoided. Although negative rake angles provide a stronger cutting edge, they result in greater pressure on the work-piece and require more horsepower to do the job. One cutter design, Fig. 13, in which the basic position of the blade is at a radial rake of 15 degrees, has proved effective for milling light non-ferrous alloys and mild cast iron. For tougher iron or steel, the necessary strong cutting edge is obtained by using a narrow negative land ground along the cutting edge. It is desirable, particularly on jobs in which this negative land is used, to hone the sharp cutting edges to remove the fine razor-sharp wire edge. This retards any tendency for minute chipping and results in greater tool life per grind.

In most respects, the elimination of chipped or broken edges on carbide milling cutters results from the same conditions that produce similar effects on single-point carbide tools. A trouble-shooting check list, such as the one shown in the accompanying table, helps to isolate the causes of poor carbide milling cutter performance and eliminate the attendant excessive costs.



**Extremely pure metals and alloys are being produced in this semicontinuous vacuum melting furnace that is installed at the Carboloy Department of General Electric Co., Detroit, Mich. The new unit, which can handle specialized heats ranging in weight from 100 to 1000 pounds, is capable of producing two 1000-pound heats per working shift. It is estimated that approximately 120,000 pounds of vacuum-melted metals will be produced each month.**



# Giant Wing Tanks Require Sound Fabricating Methods

BOEING KC-97 Stratofreighters used for military refueling operations have giant wing tanks to give them extensive range of their own. Produced by the Ryan Aeronautical Co., San Diego, Calif., the tanks combine the attributes of light weight, high strength, gastightness, and simplicity, and at the same time lend themselves to sound fabricating methods.

The tank is composed of five major circular sections which are seam-welded and spot-welded together. No rivets mar its streamlined exterior. There are no stringers or other longitudinal members. Only two compact bulkheads are used, and these are lightweight riveted assemblies which transmit the loads to the wing fittings. The structure is skin-stressed throughout its envelope of 6061 aluminum alloy.

Tank sections consist of a spun nose dome and tail cone, two spun and welded sheet sections, and a welded-sheet center section. The nose dome is a parabolic section attached to the tank with a hexagonal internal wrenching bolt. It can be quickly removed to give complete access to the tank interior. The tail cone is equipped with a soft rubber tip to prevent damage to the wing, should the tank be dropped inadvertently.

First manufacturing step is to roll the sheet into circular sections which are slightly under size in diameter, and then to butt-weld the longitudinal seams on automatic Heliarc machines. The joint obtained is practically undetectable, since it is held to the same thickness as that of the parent metal. In this way the seam offers no obstruction when the sections are later resistance-welded around their circumference.

Next, the sections are heated to 980 degrees F. in a modern elevator type furnace, then doused by a spray of cold water. This heat-treatment renders the parts more ductile for subsequent stretching and forming.

Ryan-designed expanding mandrels stretch the sections to exact diameter. These are massive machines, employing a large hydraulic ram to pull a tapered pin through a segmented set of formed shoes. In dropping, the pin expands the shoes and then stretches the sections. The tail cone taper also is formed by this machine. Dimensions can be held to within 0.025 inch without difficulty. The next step consists of aging. The sections are heated to 350 degrees F. for eight hours in a gas-fired oven to raise their yield and ultimate strengths to specified levels.

Another Ryan-designed machine trims the edges of the components to exact length. The

sections are gripped internally on a drum by the expansion of air-filled tubes. High-speed routers then move in and trim the edges as the drum rotates. Lengths are held to a 0.010-inch accuracy. After filler-cap holes and other required openings are blanked in a hydraulic press, the section is cleaned for circumferential welding.

The 6061 aluminum sheet, excellent for resistance welding because of its ductility, must be thoroughly cleaned of all grease, soil, and oxides beforehand. Any film or oxide present changes the electrical resistance of the metal, causing temperature rises and burn-throughs. The company has developed an effective cleaning agent, Raco 34, which removes the deposits uniformly. Daily records show that surface resistance is running well below the specified limit.

The sections are welded within twenty-four hours of being cleaned, since oxides will form again on the metal in a relatively short period. The components are joined to splice rings by mammoth resistance welding machines, two of which can be seen in the background of Fig. 1. (In a previous operation, the splice rings were arc-welded by a shielded inert-gas method, as in Fig. 2.) Wheel type electrodes lay down two rows of spot-welds and two rows of seam welds at each joint. Spot-welds are made on 1 1/2-inch centers, the wheels pausing intermittently to produce each one. Seam welds, actually a series of overlapping spot-welds, are made while the wheels roll. The result is a strong, gastight joint which is extremely light in weight.

Each tank section is individually pressure tested for gastightness. No sealing compounds may be used. One of the special fixtures on which this test is performed is shown in the heading illustration. Ends are covered with rubber-faced enclosures, and air under a pressure of 4 1/2 pounds per square inch is pumped into the sections. Leak-detecting fluids are sprayed on the exterior.

When the tank is completely assembled, it is suspended in the air and subjected to a second pressure test—at 3 1/2 pounds per square inch for a period of forty-five minutes. Any loss of pressure is registered on a company-devised manometer, sensitive to a drop of 1/500 pound.

At the break-away joints of the tank, aluminum-alloy rings are used. These must be machined flat on their mating surfaces to within 0.002 inch. This rigid requirement is insisted upon to prevent any fuel leakage, even at temperatures ranging to 250 degrees F. In Fig. 3, the rings are being machined on a Lodge & Shipley T-lathe. Subsequently, rings and bulkheads are drilled simultaneously to assure perfect alignment. Then the rings are roll spot-welded to the tank sections, with the welds made on 3/4-inch centers.

In static tests of the structure, tanks were placed in steel fixtures, filled with varying

**Fig. 1. Three completed wing-tank assemblies, with various sections. Circumferential welding of the sections to splice rings is performed on machines in background.**

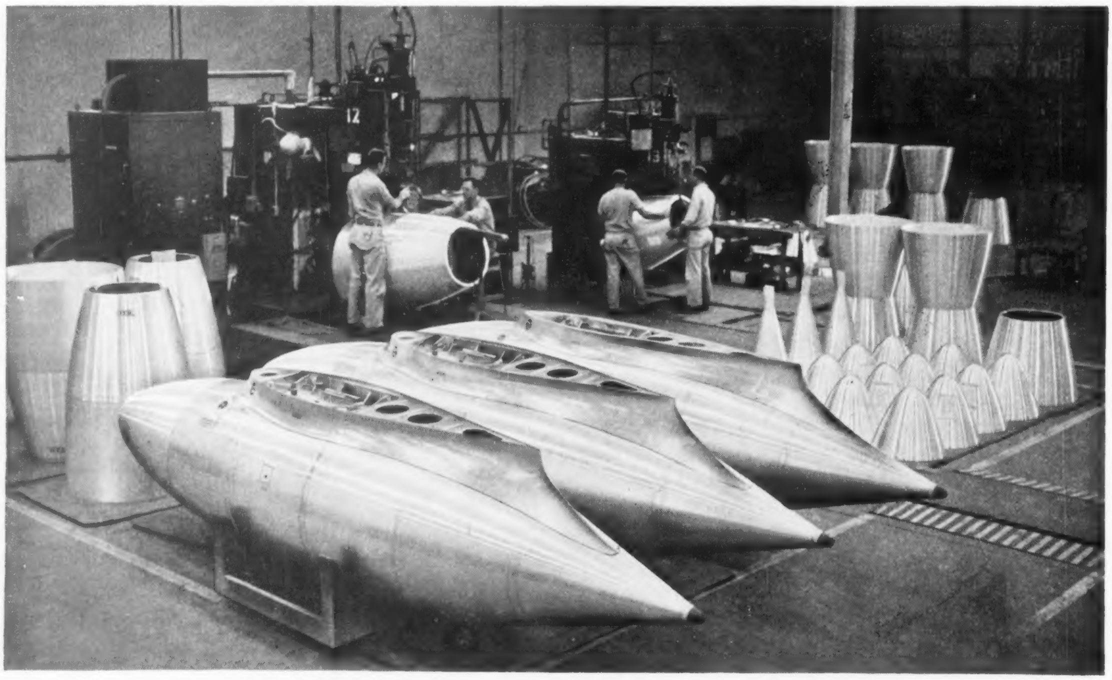


Fig. 2. A tank splice ring is arc-welded with an inert-gas shield. Rings of this type back up the tank joints.

amounts of fuel, and loads applied in different directions. At Boeing, a tank was rocked back and forth through a 30-degree angle from ten to sixteen times a minute for twenty-five hours. At the same time, the structure was vibrated at a frequency of 90 per cent of the normal rated crankshaft speed of the power plants.

The tank was subjected to temperatures of 160 degrees F. for seven days and −65 degrees F. for three days while filled with a fluid containing a staining agent. Any leakage disclosed or structural failure caused by the slosh and vibration tests would have disqualified the design.

Although the tanks are not intended to be dropped in normal use, they can be jettisoned in an emergency. This is provided for by the use of standard bomb attachment fittings for securing the tanks to the wings. A solenoid switch actuated by the pilot cuts the tanks free. Quick-disconnect fittings for fuel and electrical lines assure a clean break-away.

The only accessories within the tank are tandem-mounted, twin electric pumps which force the fuel into the main fuel system of the airplane. These units are located in a cavity in the tank bottom and are readily accessible for replacement or repairs that might be required.

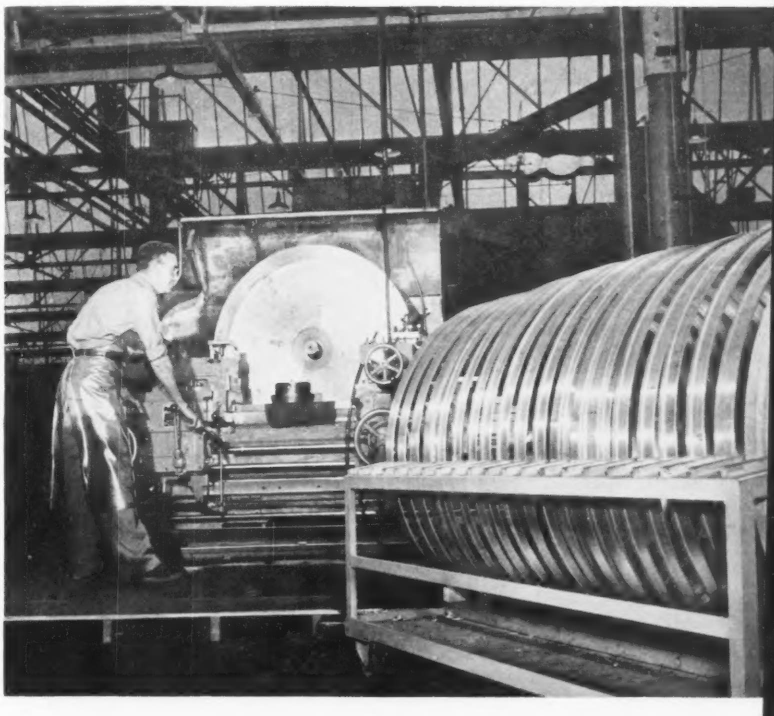


Fig. 3. Facing a large aluminum-alloy ring on a T-lathe. These rings serve to secure the tank sections at break-away joints.

# Materials OF INDUSTRY

**The properties and new applications of materials used in the mechanical industries**

### Precision Nickel-Clad Steel Strip Now Available

Lead-in wires for electronic tubes, grid support rods, and other applications where a surface of pure nickel is necessary can now be made from the thin-gage, nickel-clad steel strip rolled by the American Silver Co., 36-07 Prince St., Flushing, N. Y. The strip can be produced in thicknesses down to 0.003 inch, to tolerances as close as plus and minus 0.0001 inch, and in widths down to 0.093 inch.

### Resin-Impregnated Wood for Die Models and Patterns

A wood product, used for making die models and patterns, which exhibits good dimensional stability has been announced by the Haskelite Mfg. Corporation, Grand Rapids, Mich. "Hasko-Preg," as it is called, is made up of 1/10-or 1/16-inch solid mahogany veneers impregnated with phenolic resins and permanently bonded together in 3/4-, 1-, and 1 1/2-inch thicknesses. It is affected very little by temperature and humidity changes. The material is decay, acid, and heat resistant and is available in random widths from 4 to 20 inches and in lengths up to 96 inches. Suggested uses, besides those already mentioned, include housings for electrical control equipment and acid-bath tanks.

### Strong Industrial Adhesive Paper Tape Leaves No Deposits

Industrial holding applications which require high-strength, high-adhesive qualities with freedom from deposits in an adhesive paper tape can be performed using "No. 131 Behr-cat Flatback Tape," produced by the Behr-Manning Division of Norton Co., Troy, N. Y.

This tape can support a weight of at least 45 pounds without breaking and has an adhesive strength of 65 ounces per inch of width. It has a 4-mil rope stock backing, comes in a total thickness of 8 mils, and can withstand temperatures up to 250 degrees F.

Holding protective coverings during manufacture and packaging machine tools and other equipment for storage are two of the uses for which the material is suitable.

### Non-Flammable Stripper Removes Most Organic Finishes

Almost all organic coatings can be stripped from metal surfaces using "Octastrip 31," a paint and varnish stripper produced by Octagon Process Inc., 15 Bank St., Staten Island, N. Y. This stripper is non-flammable, is used with cold water and can be rinsed. It strips epons, urea-formaldehyde resins, modified alkyds, nitrocellulose lacquer, ester gum and oil-based finishes in 5 seconds to 5 minutes depending on the type of finish. Evaporation of the stripper takes place slowly during which time it gives off a moderate odor. Applications include the stripping of aircraft parts, automobile bodies, metal furniture, and metal cabinets.

### Non-Oily Penetrant Loosens Seized Parts Quickly

A non-oily penetrant for loosening corroded nuts or bolts or larger seized parts of mechanical equipment has been developed by the Olin Mathieson Chemical Corporation, 10 Light St., Baltimore, Md.

The product, an odorless chemical formulation, called "Puritan Penetrant," can be applied by pour spout or squirt gun. Several minutes after application the work can be struck lightly with a hammer and the parts disassembled by using the proper tools. The penetrant is available in the following sized containers: half pint, pint, gallon, and five gallon.

### Corrosion- and Wear-Resistant Bronze Valve Seating Material

High wear- and corrosion-resistance have been exhibited by a seating material for bronze valves which has been developed by The Lunkenheimer Co., Cincinnati, Ohio. "Brinalloy," as it is called, is an alloy of nickel, chromium, and

silicon which resists the corrosive action of steam, and a wide variety of acids and alkalies. Its tensile strength exceeds 150,000 pounds per square inch. The company claims that the material far outlasts the service life of any bronze valve in which it is used.

### Anti-Skidding Surface Coating Material Promotes Safety

A non-skid plastic abrasive composition which is especially suitable for application to concrete floors, ramps, platforms, around machine areas, or wherever there is a slipping hazard has been announced by American Abrasive Metals Co., Irvington, N. J. Called "Ferrox," this formulation resists the action of oil, chemicals, and weather, and covers 40 square feet to the gallon. It is generally applied to a surface by means of a trowel.

### Low Frictional Qualities Imparted to Rubber Parts

A process that incorporates a solid film lubricant into the working surfaces of rubber parts to reduce their frictional qualities has been announced by the Goshen Rubber Co., Inc., P.O. Box 517, Goshen, Ind.

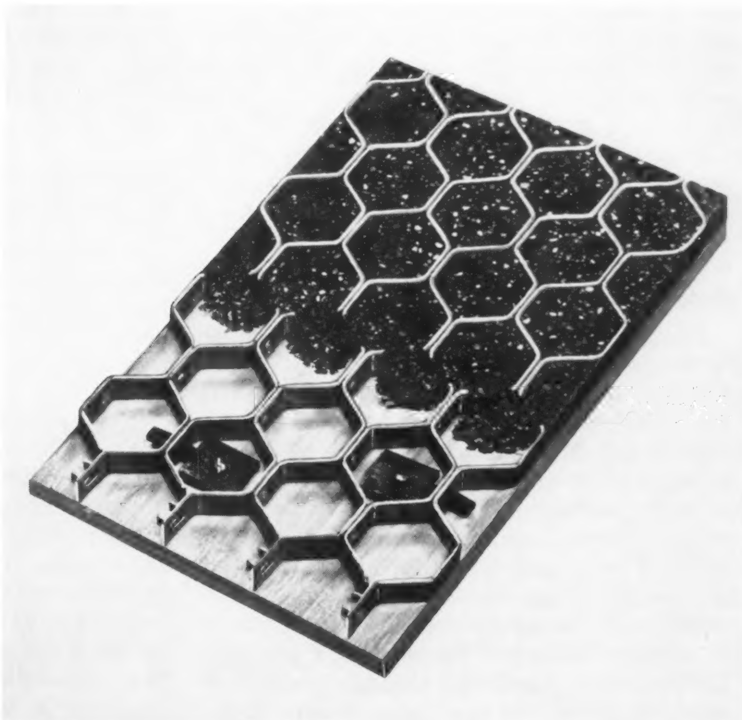
The process called "Gorlube," disperses molybdenum disulphide uniformly throughout a rubber part, as a thick, impregnated outer layer or as an impacted skin, occurring separately or in combination. The molybdenum disulphide used in this process is free of abrasive particles; unaffected in air up to temperatures of 750 degrees F.; insoluble in water, petroleum oils, hydraulic fluids, or synthetic lubricants; and is non-corrosive to metals or hydraulic fluids.

Some typical parts which are being treated are O-rings, valve seats, rubber packings, resilient mountings, and similar parts.

### Safety Floor Armor that is Lightweight

A lightweight hexagonal type floor armor which when filled with a hot or cold mastic can be used for resurfacing ramps, factory aisles, runways, loading docks, and wherever rough usage prevails, has been announced by the Klemp Metal Grating Corporation, 6603 South Melvina Ave., Chicago 38, Ill.

The accompanying illustration shows the method of installation and filling of this armor called "Baby Hexteel Surface Armor" whose size is 3/8 inch by 16 gage. The exposed steel surface armor is 18.15 square inches per square foot, and its weight is 1.7 pounds per square foot. It can be installed on existing or new concrete or wooden floors most speedily and economically by using various powder-actuated explosive fastening devices.



**The method of filling and fastening this "Baby Hexteel Surface Armor" is clearly shown. Powder-actuated explosive fastening devices may be used to fasten it on existing or new concrete or wooden floors.**

## Industrial Pen and White Ink for Marking Metals

A white ink and accompanying fountain pen that can make white markings on dark, flexible, and highly polished surfaces, which will neither flake nor rub off and are resistant to cutting oils and coolants has been announced by Time Saving Specialties, 2816 Dupont Ave., South, Minneapolis, Minn. These items are called "Vaporite Industrial White Ink" and "Jiffy-Rite" felt-nib fountain pen.

Surfaces on which the ink may be used include rubber, polished aluminum, glass, rough castings, aluminum foil, cellophare, wood, steel, black iron, copper plate, and painted, varnished or lacquered surfaces. The ink is fast drying, unaffected by light, oil, grease, or moisture. It is, however, easily removed by solvents furnished with each marking set containing the ink.

Uses to which the pen and ink can be put are: circling defective holes and rivets, marking parts for production-line assembly, code marking, and masking of templates before flushing with cutting oils.

## Porous Silver Material for Lining Bearings

A porous silver material, which may be impregnated easily with various lubricants, can be used as a bearing liner material according to its manufacturer, the Micro Metallic Corporation, 30 Sea Cliff Ave., Glen Cove, N. Y. This material can be made to carry bearing loads of 50 to 75 per cent of those capable of being carried by solid silver bearings. The amount of void volume as compared to total volume can be controlled at the time of manufacture and any desired percentage of void volume between 10 and 50 per cent may be obtained. At present the material is available in sheet form only.

## Protective Coating for Newly Cleaned Metal Surfaces

Newly cleaned metal surfaces can be preserved by a dip or spray process according to the Fidelity Chemical Products Corporation, 470-474 Frelinghuysen Ave., Newark, N. J. This coating, called "Laqua," preserves both electroplated or chemically cleaned surfaces. Metals that normally discolor by oxidation, contact with sulphur fumes, humidity, and salt spray, are kept in a bright, clean, fingerprint free condition by the use of this coating immediately after cleaning. A coating film of 0.0001 inch has an electrical resistance of 0.2 ohms at 1 1/2 volts. The material is suitable for use in the metal products, sheet metal, and automotive industries.

## Aluminum Alloy Which is Easily Welded and Fabricated

An aluminum alloy designed especially for use in aluminum fabrication and welding has been made available by the Kaiser Aluminum & Chemical Corporation, 1924 Broadway, Oakland 12, Calif. Designated as "5083," this non-heat-treatable alloy can be welded quite rapidly by using the inert-gas arc-weld method. No pre-heating is necessary and distortion is said to present no problem.

Typical physical properties of two tempers of 5083 plate are given in the accompanying table.

**Physical Properties of Two Tempers of Kaiser "5083" Aluminum**

| Property | Temper Designation | |
|---|---|---|
| | H-113 | O |
| Density, pounds per cubic inch | 0.096 | 0.096 |
| Tensile Strength, pounds per square inch | 46,000 | 44,000 |
| Compressive Yield Strength, pounds per square inch | 33,000 | 22,000 |
| Shear Yield Strength, pounds per square inch | 19,000 | 13,000 |
| Elongation, per cent in 2 inches | 16 | 21 |

The alloy is available in standard lengths in the two tempers listed in the accompanying table. Thicknesses range from 0.250 inch to 2 inches and widths from 12 to 90 inches. It has been used in numerous industries for the fabrication of such items as superstructures and hulls of ships, dump truck and tractor bodies, landing gears, cranes, and railroad cars.

## Aluminum-Containing Rust Preventative for Coating Damp Surfaces

Anyone faced with the problem of applying effective corrosion preventatives to dark surfaces which are damp, wet, or sweating may be helped by an aluminum damp coating product developed by the Xzit Chemical Co., Hoboken, N. J.

The product, called "Aluminum Serviron," has a bright aluminum color which helps in preventing voids or "holidays." Inspection of finished surfaces is also easily performed because of this color. The coating formed is non-toxic and may be used to coat water tanks, underground pipe lines, and ships' hulls.

Surfaces to be coated should be free of all oil, grease, loose dirt, and foreign matter. Application is made by spray or brush methods when the material is in a heated condition.

# Simplified Branch Joints for Tubing

By Bernhard Rogge
Evaluation Engineer, Chemical Corps
United States Army

FABRICATED T- and Y-joints in round tubing are generally indicated on engineering drawings by an arcuate line depicting the junction of the two members. To form this type of joint in small diameter tubing, a milling machine operation is usually resorted to, or a router board and a routing machine are employed. This process is time-consuming and costly, requiring special tooling and equipment. Due to the complexity of their shape, the resulting parts do not always match. Gaps, or air spaces, often remain between the adjoining surfaces.

During the welding of this type joint, a certain amount of the welded material passes between the poorly fitted pieces to the interior of the tube. Frequently, the amount of foreign material entering the tube is sufficient to partially obstruct the passage of the fluid being piped. Removal of this excess weld material is slow and is usually impossible when long lengths of tubing are involved. Scrapped parts are often the result. To overcome this problem and to maintain fabricating costs at a minimum, a straight V-cut was attempted. It was found to be ideally suited for this type of application and was one that could be easily produced.

A circular saw with the blade tilted at the proper angle will cut both the male and female parts of the joint in one set-up. The joints thus formed will result in a perfect match. When the circular saw is used in this way for quantity production, a snap-on fixture, such as the one shown in Fig. 1, should be employed to prevent the tube from rolling and to insure all cuts being in the same plane. A stop should be provided in conjunction with the fixture to furnish positive end location for the tubing. A band saw can also be used for cutting parts although it is not so accurate as the circular saw, and is, therefore, not to be recommended.

### *Height Dimension for Different Tube Sizes Presented in Tabular Form*

Various classes of joints made with the simplified straight V-cuts are illustrated in Fig. 2. For right-angle, or T-joints, only the value of height $h$, representing the distance from the surface at which the cut starts to the base of the vee, need be shown on the drawing. In cases where the tubing is not joined perpendicularly, the angle of inclination, in degrees, must be given in addition to the $h$ factor. Where the intersecting tube is so small as to make height $h$ negligible, the smaller tube end can be cut square and the larger tube merely drilled through one wall at the required point.

Tabulated $h$ factors, together with tubing sizes for both members, are presented in the accompanying table. The vertical column lists diameters for the tubing in which the female cut is to be made, while the horizontal column lists diam-

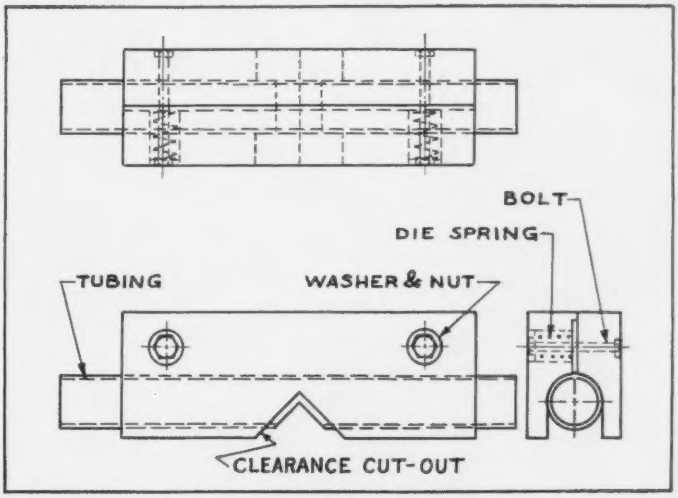



**Fig. 1. A jig, made from either wood or Masonite, prevents the tube from rotating while being cut. The tube is snapped into place and held by means of spring pressure.**

## Commonly Used Tube Sizes and Calculated *h* Factors for Simplified Branch Joints

| | Outside Diameter of Tubing with Male Cut, Inches | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Outside Diameter of Tubing with Female Cut, Inches | 1/8 | 3/16 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 9/16 | 5/8 | 11/16 | 3/4 | 7/8 | 1 | 1 1/8 | 1 1/4 | 1 3/8 | 1 1/2 | 1 5/8 | 1 3/4 | 1 7/8 | 2 | 2 1/4 | 2 1/2 | 2 3/4 | 3 | 3 1/2 | 4 |
| 1/8 | 1/16 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3/16 | ... | 3/32 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1/4 | ... | 3/64 | 1/8 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5/16 | ... | ... | 1/16 | 5/32 | | | | | | | | | | | | | | | | | | | | | | | |
| 3/8 | ... | ... | 3/64 | 5/64 | 3/16 | | | | | | | | | | | | | | | | | | | | | | |
| 7/16 | ... | ... | ... | 1/16 | 7/64 | 7/32 | | | | | | | | | | | | | | | | | | | | | |
| 1/2 | ... | ... | ... | 3/64 | 3/32 | 9/64 | 1/4 | | | | | | | | | | | | | | | | | | | | |
| 9/16 | ... | ... | ... | 3/64 | 5/64 | 7/64 | 5/32 | 9/32 | | | | | | | | | | | | | | | | | | | |
| 5/8 | ... | ... | ... | ... | 1/16 | 3/32 | 1/8 | 11/64 | 5/16 | | | | | | | | | | | | | | | | | | |
| 11/16 | ... | ... | ... | ... | 3/64 | 5/64 | 7/64 | 9/64 | 3/16 | 11/32 | | | | | | | | | | | | | | | | | |
| 3/4 | ... | ... | ... | ... | ... | 1/16 | 3/32 | 1/8 | 5/32 | 7/32 | 3/8 | | | | | | | | | | | | | | | | |
| 7/8 | ... | ... | ... | ... | ... | 3/64 | 5/64 | 7/64 | 1/8 | 5/32 | 15/64 | 7/16 | | | | | | | | | | | | | | | |
| 1 | ... | ... | ... | ... | ... | ... | 1/16 | 3/32 | 7/64 | 9/64 | 11/64 | 17/64 | 1/2 | | | | | | | | | | | | | | |
| 1 1/8 | ... | ... | ... | ... | ... | ... | 3/64 | 5/64 | 3/32 | 1/8 | 9/64 | 13/64 | 19/64 | 9/16 | | | | | | | | | | | | | |
| 1 1/4 | ... | ... | ... | ... | ... | ... | ... | 1/16 | 3/32 | 7/64 | 1/8 | 11/64 | 1/4 | 11/32 | 5/8 | | | | | | | | | | | | |
| 1 3/8 | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 3/32 | 7/64 | 5/32 | 7/32 | 19/64 | 13/32 | 11/16 | | | | | | | | | | | |
| 1 1/2 | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 3/32 | 7/64 | 9/64 | 3/16 | 1/4 | 21/64 | 29/64 | 3/4 | | | | | | | | | | |
| 1 5/8 | ... | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 3/32 | 1/8 | 11/64 | 15/64 | 19/64 | 25/64 | 1/2 | 13/16 | | | | | | | | | |
| 1 3/4 | ... | ... | ... | ... | ... | ... | ... | ... | 3/64 | 5/64 | 3/32 | 1/8 | 5/32 | 13/64 | 17/64 | 21/64 | 27/64 | 35/64 | 7/8 | | | | | | | | |
| 1 7/8 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 7/64 | 9/64 | 3/16 | 15/64 | 19/64 | 3/8 | 15/32 | 19/32 | 15/16 | | | | | | | |
| 2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 7/64 | 9/64 | 11/64 | 15/64 | 9/32 | 23/64 | 7/16 | 17/32 | 11/16 | 1 | | | | | | |
| 2 1/4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3/64 | 1/16 | 3/32 | 1/8 | 5/32 | 13/64 | 15/64 | 9/32 | 23/64 | 27/64 | 33/64 | 5/8 | 1 1/8 | | | | | |
| 2 1/2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3/64 | 5/64 | 7/64 | 9/64 | 11/64 | 13/64 | 1/4 | 19/64 | 23/64 | 27/64 | 1/2 | 23/32 | 1 1/4 | | | | |
| 2 3/4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 3/64 | 5/64 | 3/32 | 1/8 | 5/32 | 3/16 | 7/32 | 17/64 | 5/16 | 3/8 | 7/16 | 37/64 | 51/64 | 1 3/8 | | | |
| 3 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 7/64 | 9/64 | 11/64 | 13/64 | 1/4 | 19/64 | 21/64 | 25/64 | 33/64 | 11/16 | 57/64 | 1 1/2 | | |
| 3 1/2 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 3/32 | 1/8 | 9/64 | 11/64 | 13/64 | 1/4 | 9/32 | 21/64 | 13/32 | 17/32 | 43/64 | 55/64 | 1 3/4 | |
| 4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 1/16 | 5/64 | 7/64 | 1/8 | 5/32 | 11/64 | 13/64 | 15/64 | 17/64 | 11/32 | 29/64 | 35/64 | 11/16 | 1 3/64 | 2 |

*h* factors for various sizes of branch joints using simplified V-cuts

eters for the tubing that is to receive the male cut.

To illustrate the application of this table, reference may be made to Fig. 2. At W is a T-joint in which both pieces of tubing are the same size, each having an outside diameter of 3/4 inch. If these diameters are located in the table, a corresponding *h* factor of 3/8 inch will be found.

For T-joints composed of unequal size tubing, such as the one shown at X in the illustration, the same procedure is followed. In this example, the tube containing the female cut has an outside diameter of 3/4 inch, and the tube with the male cut has an outside diameter of 1/2 inch. By locating the 3/4 inch figure in the vertical column, and the 1/2 inch figure in the horizontal column, an *h* factor of 3/32 inch is obtained. Dots in the table indicate a negligible *h* factor, in which cases no V-cut is necessary.

With the two Y-joints illustrated at Y and Z, the value of distance *h* is found in the same way. The only variation in the handling of a Y-joint is in the drafting stage; the included angle of the joint must be given. However, this angle does

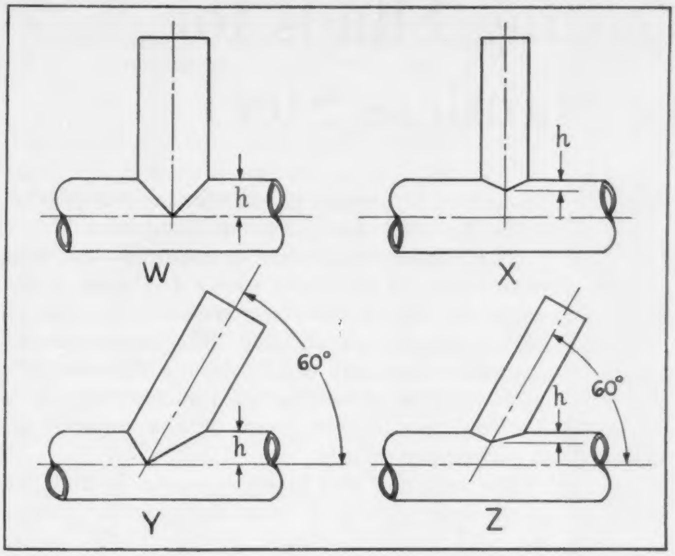



Fig. 2. Typical examples of T- and Y-joints fabricated from both equal and unequal diameter tubes. The method of finding the *h* factor is identical in all four cases illustrated.

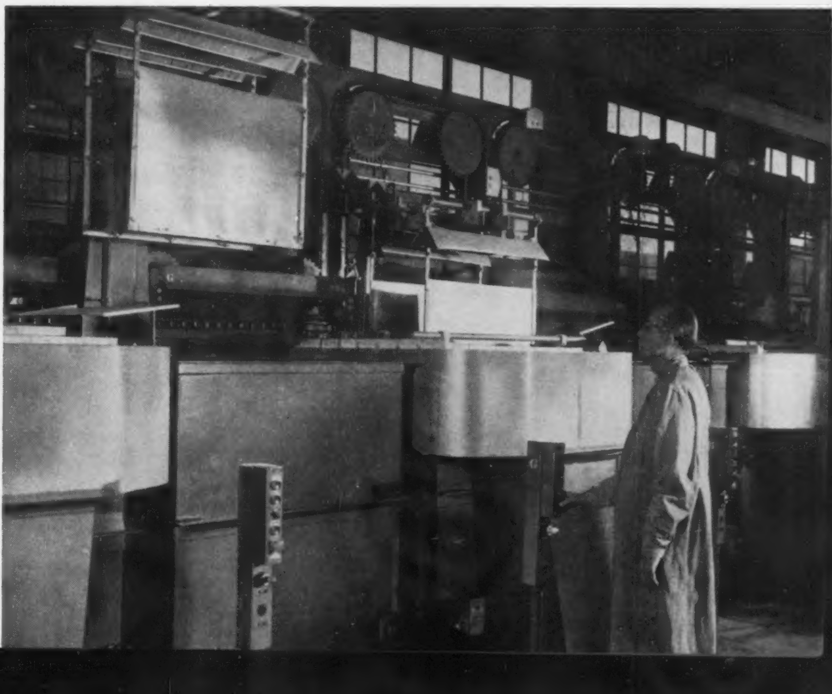
not affect the determination of the *h* factor. An added advantage is obtained in the drafting-room since straight lines may be drawn to represent the joint located at the intersection of the tubular members.

* * *

## Applications of Surface Grinding Explained in Film

"Extending the Range of Modern Surface Grinding," is a new 16-millimeter sound-color film released by the DoAll Co., Des Plaines, Ill. The film examines new grinder features and attachments that permit application of the surface grinder to hundreds of jobs other than ordinary flat grinding. Informative sequences show the use of attachments such as the high-speed spindle for grinding hard-to-reach surfaces and recesses with small wheels, and a cylindrical grinding and indexing attachment for grinding tapered, square, angular, and multi-surface forms.

Various methods of dressing the grinding wheel to achieve flat or shaped surfaces are covered. Adaptation of standard grinders to automatic operation through the use of standard attachments is also shown. To arrange for a showing of this film write: Film Division, DoAll Co., Des Plaines, Ill.



A fully automatic plating line, capable of handling large numbers of sheet-metal test panels under a high degree of control, is in operation at the Research Laboratory of the International Nickel Co., Inc., Bayonne, N. J. This automatic line permits the testing of new coatings and processes on a scale approximating that of an actual plating plant.

# Handling Cutting Fluids for Machining Stainless Steel

USE of cutting fluids in a shop devoted to the machining of ferrous metals exclusively, introduces handling difficulties due to the highly abrasive nature of the metal particles present in the spent coolant. This was the situation facing the Stainless Engineering & Machine Works Division of Cooper Alloy Corporation, Hillside, N. J.

With no central distribution system installed, it is necessary to mix the coolant solution in open tanks. From the mixing tanks, the compound is pumped into drums for transportation to the individual machines, where it is poured into the reservoir at each machine base. Up to this point in the coolant handling procedure, no difficulties were encountered.

In the interest of coolant efficiency, and to protect the operator from contact with contaminated compound, the cutting fluid at each machine was changed once each week. This necessitated the scavenging of all used coolant from the machine sump, followed by a thorough cleaning. To do this, a portable pump and motor unit was employed to transfer the used coolant from the sumps to a barrel for disposal. However, the steel chips picked up by the intake hose, in spite of the screen placed over its end, proved to be too much for the pump being used.

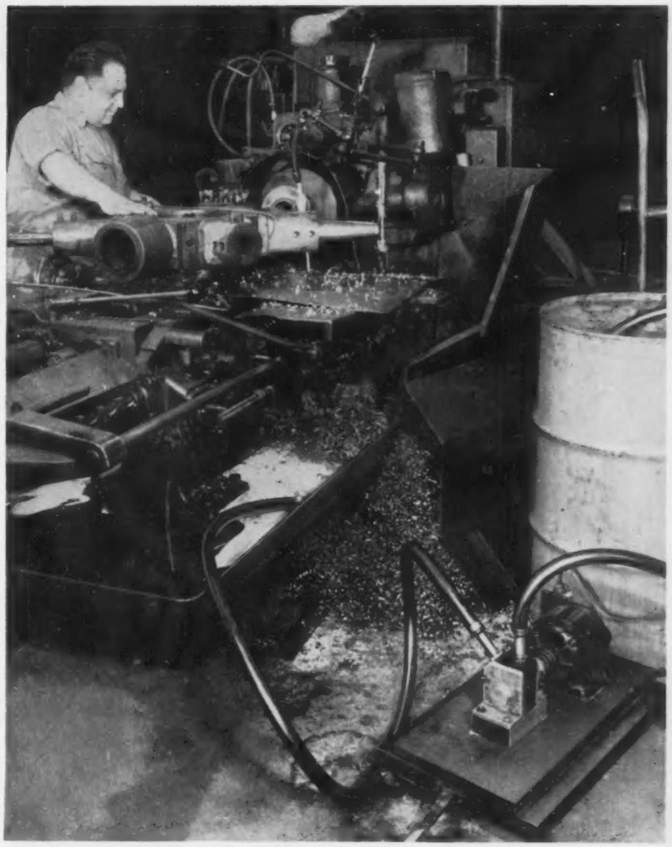
The frequent maintenance required with this set-up proved to be the prime factor in a decision to replace the pump with one that functioned around an entirely different principle. The unit that was installed as a replacement, and which is still being used successfully, is a Vanton "flex-i-liner" pump with a capacity of 5 gallons per minute.

The action of this pump is unique in that the steel chips picked up from the machine sumps are not ground between moving metal parts. Actually, the coolant is pocketed between the outside of a "Hycar" rubber liner and the inside of a Bakelite body block. The flexible liner is actuated by a rotor mounted on an eccentric shaft which, in turn, is driven by a conventional 1/4-horsepower electric motor turning over at a rate of 1750 revolutions per minute. A squeegee type pressure action is created between the liner and the body block, resulting in a positive displacement of the fluid. No shaft seals or stuffing-boxes are necessary.

The sump at the base of a King vertical boring and turning mill, which is used to machine

Fig. 1. Motor-driven portable pump is used to scavenge the coolant sump of a vertical boring and turning mill. The flow of spent cutting fluid is directed into a barrel for subsequent disposal.

Fig. 2. Cutting fluid being removed from a turret lathe chip pan by a flexible-liner rotary type pump. Stainless-steel chips drawn into the pump have had no apparent detrimental effect on the rubber liner.



simultaneously both the inside and outside diameters of a stainless-steel contour ring for a jet engine, is shown being scavenged in Fig. 1 with the flexible-liner rotary type pump. A portable base supports the motor-driven unit.

The same pump is seen in Fig. 2 being used to clean out the sump beneath a Warner & Swasey turret lathe. Operation of the lathe, on which stainless-steel slip-on flanges are being machined, need not be interrupted during this cleaning procedure.

* * *

## Welded Design Saves Two-Thirds of Indicator Cost

By changing to a welded design, the cost of an indicator for a universal coal-cutting machine made by the Jeffrey Mfg. Co., Columbus, Ohio, has been reduced by two-thirds. The indicator shows the operator the proper power setting for controlling movement of the machine and cutting bar. Slides on the indicator register by a direct flexible-cable connection to control arms on two hydraulic pumps.

As originally manufactured, the indicator was machined from a solid block of AISI C1045 steel, and appeared as shown at the top in the accompanying illustration. By substituting two short lengths of pipe and joining them by arc welding, machining time was reduced drastically. The revised design is seen at the bottom of the illustration. In addition to being produced at one-third the cost, assembly is simplified because the cable, indicator slide, and modified pipe plug can be put together separately and then attached to the indicator body as a unit. The photograph of the indicators is through courtesy of the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio.


Welded design of coal-cutting machine indicator (seen at bottom) is produced at one-third the cost of the previous design (shown at top)

# Oil-Pump Bodies Completed on Two Machines

CAST-IRON oil-pump bodies for Chevrolet's new Turbo-Fire V-8 engines are completely finished, ready for assembly, on two automatic, rotary table indexing machines. These hydraulically operated, multiple-spindle machines, made by the Michigan Drill Head Co., Detroit, Mich., are installed in the modern Van Slyke Road Engine Plant of the Chevrolet Motor Division, General Motors Corporation, Flint, Mich. Each machine is capable of completing 120 castings per hour.

Previously, the many operations required on such parts were performed individually on different machines. This procedure necessitated costly handling of the work-pieces between machines, and prior machining of locating spots for positioning of the pump body in each machine.

Now, all surfaces and holes on the contact-face end of each casting are completed—including finish-boring of the gear pockets—on one machine, and those on the mounting-face end on the second machine. Thus, only one handling of the parts is required, and machined locating spots are no longer needed since all operations are done on the first machine without releasing the work-pieces. The finish-bored gear pockets are used for locating in the second machine.

Both machines are built around standard hydraulically operated, multiple-spindle drilling machines. The rotary indexing tables are also hydraulically operated, and milling heads are mounted on standard, way type units. The use of standard equipment reduces the cost of the machines, makes faster delivery possible, and permits easy conversion to the manufacture of other parts.

The first automatic, rotary indexing machine, having twelve stations, is shown in Fig. 1. Castings are loaded, and machined oil-pump bodies are unloaded at the first station. A two-spindle milling head, seen at the right, straddles the second and third stations for successively rough- and finish-milling the gear-pocket faces at these positions. The gear-pocket faces (or contact face of the oil-pump body) must be flat and smooth within 0.0005 inch per inch, and free from chatter and tool marks.

The spindle at the second station carries a special Goddard & Goddard Serratip shell end-mill cutter, 4 1/2 inches in diameter and having eighteen carbide-tipped blades, while the spindle at the third station is equipped with a Wesson Rigidcut face-milling cutter, 5 inches in diameter and also having eighteen carbide-tipped blades. The roughing cutter is rotated at 210 R.P.M. (192 feet per minute) and the finishing cutter at 255 R.P.M. (234 feet per minute), while both are fed across the gear-pocket faces at the rate of 38.16 inches per minute.

Stations 4 through 10 are covered by the vertical column unit seen at the left, which has an eighteen-spindle head, an eighteen-hole bushing plate, and three guide bars with mating bushings. At the fourth station, two mounting

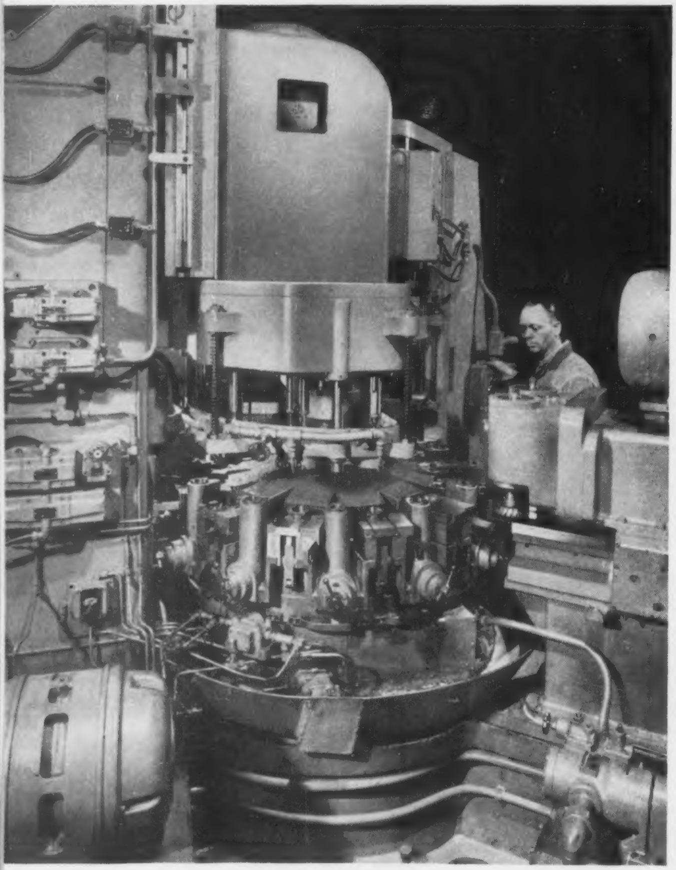


**Fig. 1. Contact face of cast-iron oil-pump body is rough- and finish-milled; two gear pockets are rough- and finish-bored; two shaft holes are drilled, reamed, and chamfered; and four cover screw-holes are drilled, chamfered, and tapped on this machine.**

Fig. 2. This second automatic, rotary indexing machine completes the oil-pump bodies so that they are ready for assembly to V-8 automotive engines. Drilling, reaming, and milling are performed at the seven stations.

holes 13/64 inch in diameter are drilled through the flange, and one hole 29/64 inch in diameter is drilled through one shaft hole of each oil-pump body. These high-speed steel drills, as well as the tools at the next station, are rotated at the required revolutions per minute to provide a cutting speed of 80 feet per minute, and are fed at the rate of 6.40 inches per minute.

When each body is indexed to the fifth station, two more mounting holes are drilled through the flange, and the other shaft hole is drilled. At Stations 6 and 7, the four mounting holes in each casting flange are chamfered, the two gear pockets are rough-bored, and both shaft holes are chamfered. The gear pockets are finish-bored to a diameter of 1.5045 inches at the eighth and ninth stations, one being bored at each station. It is essential that the pocket bores form square corners with their bottom surfaces. Special four-flute, carbide-tipped tools are used for boring. The tools for rough-boring also perform the chamfering of the drive-shaft holes. The boring tools are rotated at 200 surface feet per minute, and fed at the rate of 6.40 inches per minute.

The four mounting bolt holes through each oil-pump body flange are tapped with 1/4–20 threads at the tenth station. Splined spindles rotating at 59 surface feet per minute, and individual lead-screws are employed for the tapping operations. Six-flute, carbide-tipped reamers are mounted on the spindles at Stations 11 and 12 for finishing the shaft holes within plus or minus 0.0005 inch of the specified sizes. The reamers are rotated at 1600 R.P.M. (200 feet per minute), and fed at the rate of 0.020 inch per revolution (32 inches per minute). Pump bodies are unloaded when returned to the first station.

The second automatic, rotary indexing machine, Fig. 2, has eight stations. Pump bodies are again loaded and unloaded at the first station, locating from the finish-bored gear pockets. A hydraulically operated, horizontal machine unit, seen at the left, carries a special two-spindle milling head for use at Stations 2 and 3. At the second station, a half-side milling cutter, 7 inches in diameter and having twenty inserted carbide blades, and a similar cutter, 5 1/2 inches in diameter and having sixteen inserted carbide blades, are mounted on the same arbor with a spacer collar between. These cutters, rotating at 226 feet per minute, are used to straddle-mill the mounting face and bolt-head seat on each pump body.

A face-milling cutter, 5 inches in diameter with eighteen carbide-tipped blades, is mounted on the spindle at Station 3 for finish-milling the body mounting face. This cutter is rotated at 193 R.P.M., corresponding to a cutting speed of 253 feet per minute. All three milling cutters are fed at the rate of 25.12 inches per minute.

The standard vertical-column unit, seen at the back of the machine, carries a five-spindle drill head and a five-hole bushing plate for the operations performed at Stations 4, 5, and 6. Two holes 15/64 inch in diameter are drilled at the fourth station, one hole 15/32 inch in diameter for a cap-screw is drilled at the fifth station, and two dowel holes 0.2492 inch in diameter are reamed at the sixth station. A cutting speed of 80 feet per minute is employed for drilling, and 40 feet per minute for reaming. Both the drills and reamers are fed at the rate of 7.3 inches per minute.

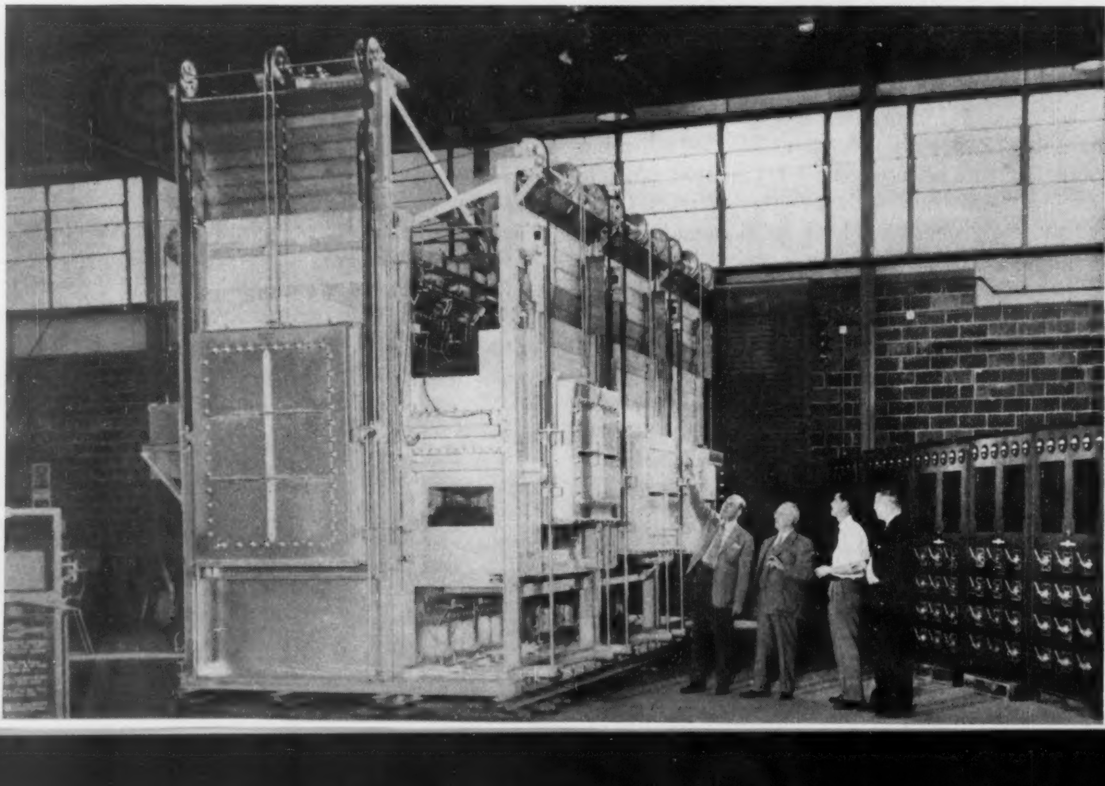
An angular oil-passage hole, 7/16 inch in diameter by 2 3/8 inches deep, is drilled in the oil-pump body in two passes—half-way at Station 7, and to full depth at Station 8. This hole forms an angle of 15 degrees with the mounting face. These drills are rotated at 80 surface feet per minute and fed at the rate of 6.28 inches per minute (0.009 inch per revolution).

# In Shops Around

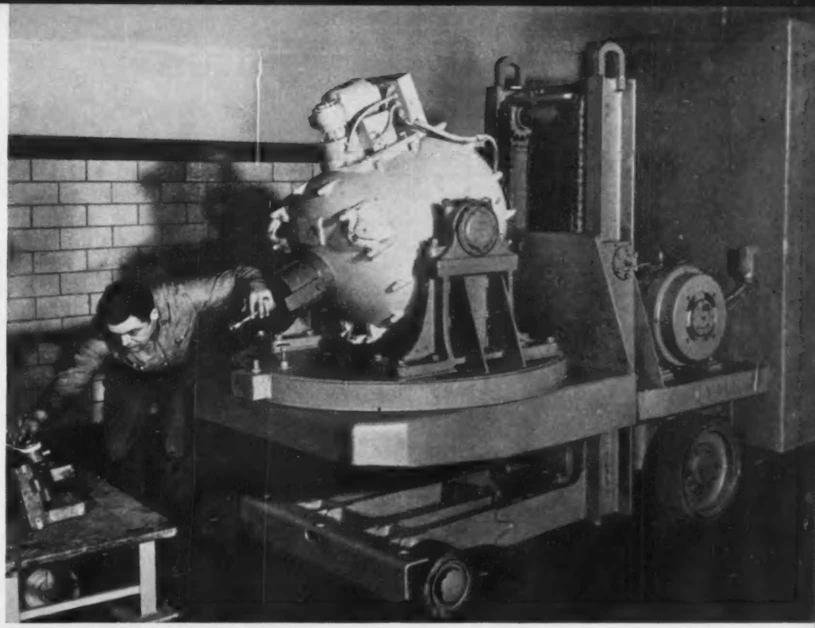
**Camera highlights of some interesting operations performed in various metal-working plants throughout the nation**

Surrounded by spun glass wedges in a new anti-echo chamber, a General Electric engineer is using a microphone and an oscilloscope to trace the direction of sound and to measure the total sound output of one of the company's newest motors. The spun glass interior of the chamber eliminates reflected sounds and enables measurement of the direct sound of equipment tested.

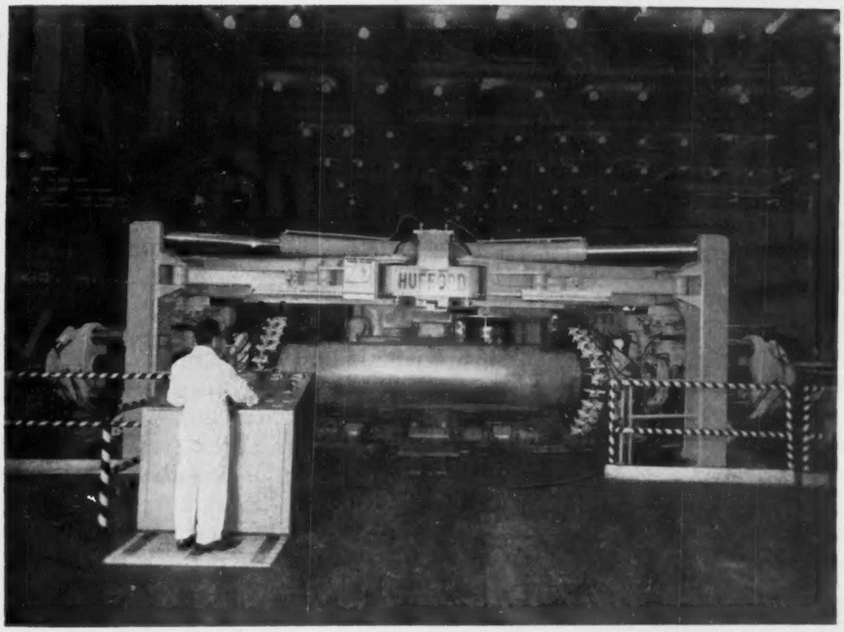
This mammoth Hayes electric steel forging furnace, claimed to be the world's largest, will soon be in service at the United States Air Force heavy-press facility at North Grafton, Mass. The furnace will heat steel billets to a temperature of 2400 degrees F. for the 50,000-ton closed-die forging press now being installed. Heating chamber accommodates 10,000 pounds of billets up to 16 feet in length.



# the Country



Inspecting a specimen with an "Isoscope" at the Barberton, Ohio, works of Babcock & Wilcox. Developed by the company, this new inspection device utilizes radioactive cobalt 60, and can see through steel up to 7 inches thick. The Isoscope consists of a lead sphere encased in a steel jacket with an integral rotating section that is aimed at the specimen.



Stretch-forming compound contours in titanium sheets at the El Segundo, Calif., Division of the Douglas Aircraft Co. The 0.080-inch thick sheets, 48 inches wide and 177 inches long, cost approximately $2000 each, and are believed to be the largest ever formed by this process. They are used on nacelles of the Douglas DC-7 series transports.

Twisting wires for aircraft electrical circuits is done mechanically at the Glenn L. Martin Co., Baltimore, Md. The wires are supported between a stationary head and a slow-speed revolving head controlled from a cable switch. The wires run through a comb which is moved along by the operator to lead them during the twisting.

# Tooling for Cold Steel Extrusion

**An article dealing with pertinent tooling factors for the cold extrusion method of forming steel, based on a paper presented at a recent Annual Meeting of the American Society of Tool Engineers.**

By J. F. Leland, Manager
Metal Forming Division
Parker Rust-Proof Co.

TOOL design can be the difference between success or failure in the production manufacture of any item by the cold extrusion process. Stated simply, extrusion involves reforming a given quantity of metal until it assumes a usable shape and surface finish, as contrasted with the usual manufacturing procedure of starting with an over size piece of metal and disposing of that portion which is machined away in producing the desired shape.

Assuming that a product is adaptable to cold extrusion, basic tool design principles can be laid down for obtaining a given shape. Although other factors such as lubrication, the number and variety of cold-work operations, and the raw materials and their heat-treatment must be closely analyzed and controlled, they cannot counteract improper tool design and construction.

Extrusion operations can be divided into two main categories, backward extrusion and forward extrusion. In backward extrusion, as the descending punch enters the slug, which is contained in a closed die, the displaced metal is compelled to flow upward around the punch in the opposite direction to that of the punch movement. Wall thickness of the part thus produced is equal to the clearance between the punch bearing and the die.

In a forward extrusion, the descending punch forces the confined metal to flow through the die in the same direction as that of the punch travel. The diameter of the extruded section is determined by the diameter of the die bearing. If a tubular section is being formed, the wall is determined by the clearance between the punch extension and the die bearing.

### *Backward Extrusion*

In the cold forming of steel by this method, the maximum tolerable working pressures are being approached with regard to the tooling, therefore all factors concerned should be reviewed carefully. The extrusion operation is performed on a cut or sized slug. Bottom thickness of the cupped shape produced should be equal to, or greater than the wall thickness at the junction with the base. The inner wall should be straight and the cavity bottom fairly flat; the outside wall may be tapered or stepped. Whenever it is possible to adhere to these basic shapes, maximum extrudability can be obtained with excellent tool life even at high production rates.

### *Punch Design for Backward Extrusion*

As might be expected, the punch shape for backward extrusion is extremely critical, and the design illustrated in Fig. 1 should be closely followed. The factors affecting such design are distribution of lubrication, punch radius, punch bearing, and punch relief.

A comparatively small pre-lubricated area must furnish lubrication and separating media between the punch and work-piece over the entire cavity area during extrusion. With punch face angles ranging from 5 to 7 degrees, as shown, the flow of surface metal with chemically affixed lubrication is so distributed that some lubrication remains at the bottom of the cavity after completion of the stroke. Flatter punches tend to increase the unit loading on the punch and to retard the flow of surface metal directly under it, thus reducing the lubrication available at the side walls. Although sharper angles on the punch face tend to reduce the tonnage required for the operation, they cause the surface metal carrying the lubricant to flow from under the punch early in the stroke. This robs the punch of adequate lubrication later in the stroke, thus causing leading and galling as well as early tool failure.

The radius at the junction of the punch face and bearing, which should be as small as possible, is dependent on the diameter of the punch and the rate of metal flow at this point. Under

ideal conditions, the metal actually overshoots this portion of the punch, thereby reducing friction on the bearing and providing clearance for withdrawal.

The punch bearing is made relatively short to reduce contact area and frictional resistance between the punch and work-piece. This contact should be slight if there is an optimum angle on the punch face, and a small radius at the intersection with the bearing. Tendency for wear is reduced and punch life increased.

Because the lubricating layer is greatly thinned in the extrusion operation, any contact between the rest of the punch and the work-piece should be minimized. Diameter $D_1$ of the illustrated punch is therefore relieved slightly. The upper bearing radius should be carefully blended into the relieved diameter so that no sharp edges remain to cause scoring of the work on withdrawal of the punch.

The relieved section should be of sufficient length to assure that the wall of the extruded cup does not, under any circumstances, contact the enlarged shoulder $D_B$. Should this occur, the metal will upset into the relieved section, frequently resulting in punch breakage, die breakage, and sometimes press failure. The enlarged shoulder serves to strengthen the punch, but may also act as a locating member in the upper part of the die.

### *Depth of Penetration*

Depth of penetration in backward extrusion is closely related to three factors: the shape of the punch, the speed of pressing, and the lateral stability built into the tooling. At practical reductions, a penetration of two and one-half times the punch diameter appears to be a safe maximum for production operations. Beyond this point, considerable trouble has been experienced in maintaining concentricity and preventing punch breakage.

In maintaining production at maximum penetration, considerable care must be exercised to control the factors tending to affect the side thrust of the punch. Among these factors are use of an indented or faced slug to assure correct initial location of the punch, perfect alignment of the punch and die under press loading, lateral rigidity of both the press and the tooling, and adequate lubrication to prevent galling and the resultant tendency to produce punch drift. Even though tolerances and run-out may not be the main consideration in the finished product, it must be remembered that continual stressing, other than that of compression, can cause repeated punch breakage where deep penetrations are involved.

The per cent of reduction of a backward extrusion is simply the change in cross-sectional area at the extruded section expressed in terms of percentage. It bears little relationship to the depth of penetration or the length of the extrusion. Evaluation of the per cent reduction should be made at the cross-sectional area of severest cold work, using the equation:

$$\frac{A_b - A_e}{A_b} \times 100 = \text{per cent reduction}$$

in which

$A_b$ = cross-sectional area of the blank;
$A_e$ = cross-sectional area of the extruded section.

Other factors being equal, such as tooling and lubrication, the limitations in per cent reduction depend mostly on the amount of cold work applied. With SAE 1010 to 1020 steel, this reduction limit usually ranges from 50 to 70 per

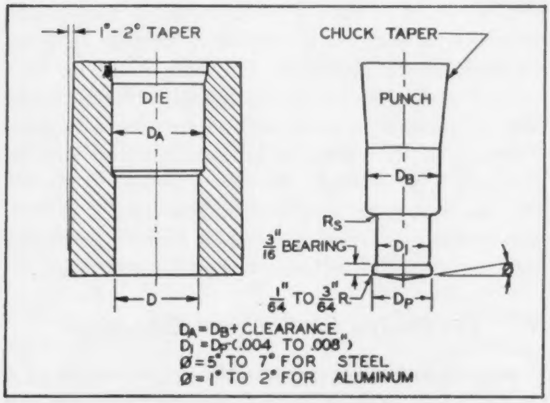



**Fig. 1. Typical die and punch designs intended for use in a backward extrusion operation. The shape of the punch in this type operation is critical.**

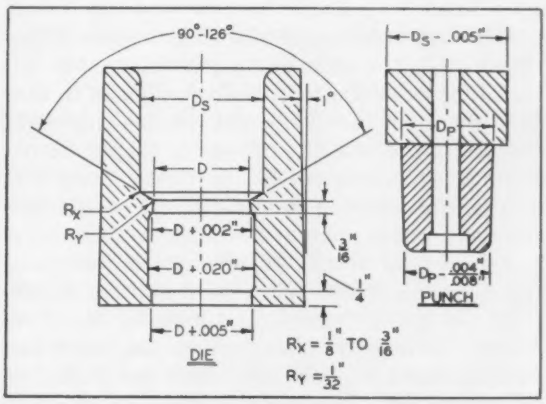



**Fig. 2. Design of a die and punch to be utilized in forward extrusion. In this operation, the punch shape is not so important as in backward extrusion.**

cent. As carbon content of the work-piece steel increases, the reduction limit decreases due to the greater tendency of the material to work-harden.

Tooling limitations are reached when hardness of the extruded section approaches 90 to 100 Rockwell B. If thinner sections are required, it may be necessary to introduce a second operation following annealing.

### *Die Design for Backward Extrusion*

Die design recommendations to achieve maximum metal flow are illustrated in Fig. 1. It may be noted that the die ring has a comparatively thin section. The knock-out block (not shown), which nestles in the lower die section, should have a height equal to, or greater than its diameter to prevent any tendency to cock when ejecting parts. The die is relieved at diameter $D_A$ for much the same reason that the punch is relieved above the bearing. Therefore, metal flowing in a direction opposite to that of the punch contacts neither the punch, once it passes the bearing, nor the side wall of the die. The relieved die section may also serve as a guide for the punch, assisting in maintaining tool alignment and work concentricity. Backward extrusion dies should be so designed that maximum horizontal force components are distributed midway between the top and bottom of the die retaining system.

### *Forward Extrusion*

In the forward extrusion method of cold forming, the starting blank may be sawed, sheared, or coined if the extruded section is to be a solid. If a hollow shape is to be formed, the blank may be a tubular section or a cup which has been drawn or extruded from a blank in a previous operation.

With the work-piece placed in a close-fitting die, Fig. 2, the descending punch confines the metal blank at the top, while forcing it to flow through a restricted opening in the bottom of the die. In the case of a cupped or tubular blank, a punch extension enters the blank cavity and serves as a mandrel to establish the wall thickness and inside contour of the extruded shape.

A heavy lip usually remains at the mouth of the extruded shape. When solid or tubular sections are being formed, and cross-sectional reduction is the only consideration, the punch can be withdrawn and the next blank inserted. The following press stroke will push the previous extrusion through the die, thus eliminating the unwanted lip.

### *Punch Design for Forward Extrusion*

The punch shape, Fig. 2, for forward extrusion is generally not so critical as in the case of backward extrusion. Under certain conditions, however, the punch extension may require more careful consideration. The punch and die are a close fit to prevent metal from flashing between them.

The punch extension used in extruding hollow sections is usually a separate member assembled to the punch proper, and the forces acting upon it during extrusion are those of compression in a horizontal plane, and tension in a vertical plane. This extension passes into the tubular blank and locates at the die bearing before the punch begins to compress the metal. When cupped shapes are being used as blanks, the mass of the blank must be closely controlled, and the length of the punch extension carefully calculated, to insure that the extension will bottom in the blank at the same time that the punch shoulders on the work.

If bottoming of the extension occurs prior to total confinement of the slug, tool damage may occur, or the bottom may be knocked out of the work-piece. On the other hand, if total confinement occurs prior to bottoming, the cavity shape will not be maintained. It is usually necessary to provide an air bleed through the center of the punch extension to allow air to enter the rapidly enlarging cavity that is formed as the extrusion progresses.

A taper of a few thousandths of an inch should be provided on the punch extension. This slight taper is necessary to reduce the frictional drag created on the extension as the metal flows rapidly in contact with it. In the case of parts with small inside diameters, requiring punch extensions of smaller cross-section, it becomes necessary to increase the taper on the extension to avoid tensile failure due to the frictional load.

Per cent of cross-sectional reduction practical in a forward extrusion is of the same magnitude as that in a backward extrusion, that is, ranging from 50 to 70 per cent. The slug must be uniformly annealed and properly phosphate-coated and lubricated to maintain performance in production. With adequate lubrication and proper tooling, solid sections can be extruded to almost any desired practical length. The length of hollow and cupped sections will be limited generally by the strength built into the punch extension.

### *Die Design for Forward Extrusion*

A forward extrusion die, Fig. 2, consists of a one-piece ring that accommodates the blank in the upper portion, and has a shoulder on the inside diameter to form an orifice. It is through this

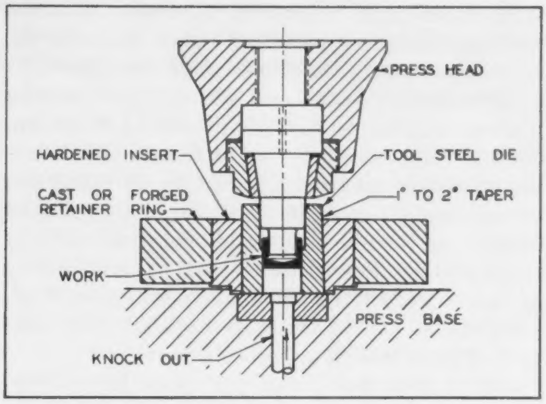



**Fig. 3. Tooling assembly for the backward extrusion process. The retainer ring is shrunk over the hardened insert to provide an initial compression load on the internal member.**

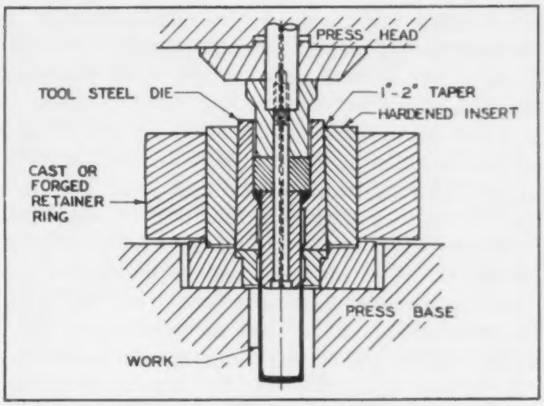



**Fig. 4. Typical tooling set-up for forward extrusion. A relief hole is provided through the punch assembly to permit air to enter the extending work-piece cavity.**

orifice that the metal is forced to flow. The die ring has the following features designed to obtain maximum metal flow: A rounded mouth to guide the punch as it enters; a straight-sided die cavity blending into the extrusion shoulder, or bearing, with a radius ($R_X$); an extrusion shoulder having an included angle ranging from 90 to 126 degrees; a relatively sharp radius ($R_Y$) at the junction of the extrusion shoulder and the bearing, ranging between 1/32 and 1/64 inch. The bearing should not be longer than 3/16 inch, having a back rake of 0.002 inch.

Frictional load is minimized by relieving the die below the bearing. If the extrusion is long, an occasional narrow and close-tolerance guide may be required to maintain straightness.

When heavy reductions are involved, a comparatively flat included die angle at the extrusion shoulder and a sharp radius at the bearing are important features. Most of the cold work occurs at the shoulder, and a flatter shoulder retains lubrication in this area. As the metal flows over the bearing radius it is being thinned, and must have as little frictional contact with the tooling as possible. The flat shoulder and sharp bearing radius combine to promote overshooting of the cold-worked metal, thereby producing a clearance between the extruded part and the die bearing. Smaller included angles at the shoulder and larger bearing radii can lead to galling of the extruded section on the downward stroke, as well as sticking and galling during ejection.

While it is true that smaller included angles reduce the tonnage required for the extrusion operation, it is important to note that larger angles direct much of the pressure to the bottom of the die ring and thus to the press bed. In this way, the horizontal force components tending to split the die ring are substantially reduced. Again, as in the case of backward extrusion, the die should be so constructed that the blank under compression is located about midway between the top and bottom of the retainer system.

### *Extrusion Tooling Assemblies*

Extrusion tooling assemblies, Figs. 3 and 4, are unique in several respects. An outside retainer ring of either cast or forged steel is shrunk onto a hardened insert to provide a compressive force on the inner member. The hardened insert has an internal taper of 1 to 2 degrees, matching the taper on the outside of the die ring. The retainer assembly is forced down over the die ring by means of bolts or clamps to compress the die ring approximately 0.005 to 0.008 inch on a diameter ranging from 2 to 3 inches. This compression pre-loads the die ring so that, during the work cycle, it can better withstand the forces tending to expand and ultimately crack it.

The base of the intermediate ring, or hardened insert, is so designed as to locate the assembly over a hardened block recessed in the press bed. Vertical extrusion forces are then distributed over a greater area than that represented by the base of the die ring. The hardened block may also house replaceable work guides in forward extrusion tooling assemblies, or bushings for locating the knock-out punch in backward extrusion tooling assemblies.

A cone-shaped bushing, located within a threaded nut, locks the backward extrusion punch in the ram, Fig. 3. Working load is distributed through hardened plates backing the punch. These plates should be of adequate proportions to prevent wear on the ram mount.

The forward extrusion punch, Fig. 4, is backed by a hardened plate. Various punch components

are located and held in place by means of a through-bolt. This construction permits replacement of the tapered nose section when worn, or when it is desired to alter the punch length.

As shown in the illustrations, the entire weight of the die assembly is carried on the bottom face of the die ring proper. This area must be sufficiently large to distribute that part of the work load not borne by the knock-out. Although the hardened insert may be used to locate the die assembly, it must float above the press bed, with the retaining ring, so that no bending moment of the bolster under heavy loading is imparted to the retainer assembly. Should the retainer or insert rest on any support, the assembly would be pressed apart due to the pre-loaded construction of the retainer assembly.

Pressing speeds are an important factor in obtaining the desired flow of metal. At lower speeds, the metal is given time to change direction and to follow closely around the bearing radius where the greatly thinned film of lubricant causes a substantial increase in frictional load. At higher speeds, the metal is made to overshoot the bearing radius, thus greatly reducing the chance of galling or seizing on either the compression or return strokes. Once started, galling may become progressive and can eventually cause increased tool loading, leading to failures such as upsetting or cracking.

The limiting factors at higher speeds are the impact and dynamic stresses on the tools. Hydraulic cushions on the ram are of definite advantage in reducing tool shock. Without such cushions, however, average pressing speeds ranging from 6 to 15 inches per second have given satisfactory performance.

### *Punch and Die Life*

Dies and punches have, for the most part, been made from various high-speed steels having a hardness ranging from 60 to 65 Rockwell C. Tool steel punches, if properly heat-treated, can be expected to produce between 25,000 and 75,000 parts before fatigue failure occurs. With adequate lubrication, wear is seldom a factor.

More recently, carbide tooling has been employed on production jobs. Well designed set-ups have been used to turn out hundreds of thousands of parts with no sign of tool failure. It would appear that, with good control of various factors, there is no limit as to what can be expected in the way of tool life.

In the preparation of extrusion dies and punches, certain precautions must be taken. Care should be exercised to eliminate all grinding marks, even before heat-treating, because it is at these grinding marks that stress cracks and fractures have their beginning. Wherever possible, final polishing on both the punch and the die should be done in the direction of metal flow.

Because tool design and lubrication have such a direct bearing on tool life, it will be found unwise to compromise on either factor. When trying to obtain maximum reduction or maximum penetration, it is best to utilize the basic tool shapes and then, in a separate operation, restrike to obtain the desired cavity shapes. In the case of lighter reductions and shallower penetrations, compromise can be made if the basic reasoning behind good tooling is borne in mind.

One phenomenon relating to poor lubrication, poor tooling, or both, is known as cross-checking. This usually shows up on heavily cold-worked areas. These fine hairline cracks on the work surface may not be accompanied by galling, but indicate a high rate of internal metal flow due to surface friction. Cross-checking results in a weak part having poor physical properties.

### *Lubrication*

A major portion of the success of cold extrusion in commercial applications has been attributed to the introduction of phosphate coatings as a separating layer and lubricant carrier. During World War II, the Neumeyer Metal Works of Nuremburg, Germany, had been experimenting with a phosphate coating material developed in the United States. This material, "Bonderite," produced a coating which could perform all the functions of the metallic coatings, could withstand the temperatures and pressures involved in cold extrusion, and was comparatively simple to apply and remove.

As a result of reports by United States Army inspection teams, experimental contracts were issued in this country to investigate further the applicability of cold extrusion for the production of ordnance items. In the meantime, progress had been made in the formulation of important phosphate coating materials. These materials were being employed in this country on such heavy cold-working operations as tube and bar drawing.

As with any chemical treatment of metal, surface preparation is of prime importance in obtaining consistently good performance. Complete removal of scale, surface oxides, grease, and soil is essential to obtaining a uniform etch and phosphate coating growth on the base metal. If not completely removed, brittle and abrasive oxides and surface scales flake off during severe deformation, thus exposing bare metal and contributing to excessive tool wear and down time.

The lubricant must provide an uninterrupted film and separating, or anti-flux, layer between

the tools and work-piece. Not only the prosphate coating, but also the lubricant must therefore be virtually integral with the metal surface to avoid flow away from bearing areas and the possibility of metal-to-metal contact.

The coating and lubricating cycle for a production facility is usually carried on in automatic equipment of the indexing type, similar to automatic platers, or in specially designed equipment utilizing an automatic, continuous conveying system. However, in the development stage of an extrusion project, it is of definite advantage to have available a series of properly designed immersion tanks complete with monorail, hoist, and trunnion basket. Such an arrangement provides the greatest flexibility in working out optimum time cycles, particularly in cleaning, which will vary with the condition of the raw stock, the annealing cycle used, and the type of soil present.

* * *

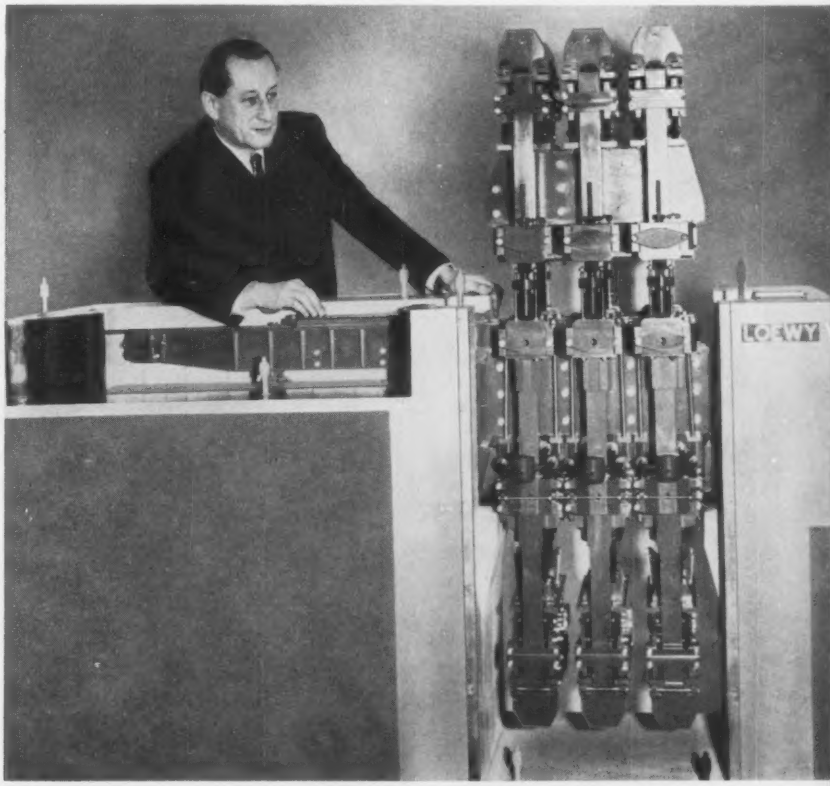
## Steel Production in 1954

Steel production in this country during 1954 totaled 88,300,000 net tons of ingots, 9 per cent over the annual average for 1940-1949. The eighty-four steel-producing companies have plants in 118 communities in twenty-seven states. They have 1216 steel-making furnaces.

## Research Scientists "Grow" Pure Iron Crystals

Slivers of pure iron, having a breaking strength approaching 1,000,000 pounds per square inch, have been produced by scientists at the Westinghouse Research Laboratories, Pittsburgh, Pa. Each of these slivers, or "whiskers," is a pure iron crystal so perfect that no defects can be detected in its structure. The crystals are as long as 2 inches, having a thickness of 0.001 inch. Little is known about metals that are completely free from impurities and imperfections because they are never found in nature and, until recently, could not be prepared in the laboratory.

Highly purified iron chloride was heated to a temperature of approximately 1100 degrees F. in a special furnace containing an atmosphere of hydrogen gas. Through rigid control of the temperature and the flow of hydrogen, the chlorine atoms in the iron chloride were allowed to unite chemically with the hydrogen at a fixed rate. This left unattached atoms of iron which migrated slowly toward each other and were deposited one upon the other in a perfect arrangement. In this way, billions of iron atoms "grew," with no observable defects, into a single crystal of pure iron.




Erwin Loewy looks at a scale model of the 50,000-ton closed-die hydraulic forging press designed by his company and now undergoing final assembly at the United States Air Force plant in North Grafton, Mass. The press is being installed next to one of 35,000-ton capacity already operating, which was described in an article in June MACHINERY, page 164. Unique "upside down" arrangement of both presses places all main cylinders and hydraulic piping deep in the foundation, and permits the weight of the entire upper entablature to be effective in building up the pressure over the dies.

# Computer Solves Machinability Problems

An electronic machinability computer has been revealed by the Carboloy Department of General Electric Co., Detroit, Mich. The device will solve machining problems, which normally require several hours to compute, in less than two minutes, and with consistent and reasonable accuracy.

Application of this new engineering tool will enable methods and service men to determine quickly whether or not the most advantageous set of conditions is being employed for machining a current job, help them arrive at optimum conditions for setting up a new machining operation, or indicate the relative advantages of changing some of the present operating conditions to obtain greater production.

The thirty-two-pound, self-powered analog computing unit measures 21 inches in height, 7 inches in depth, and 20 inches in width. It will evaluate up to fourteen different operational variables in machining, as follows: work-piece alloy, microstructure, surface condition, and hardness; cutting fluid; tool material, rate of feed, depth of cut, cutting speed, flank wear land, tool profile, type of tool, number of teeth, and finally, tool life.

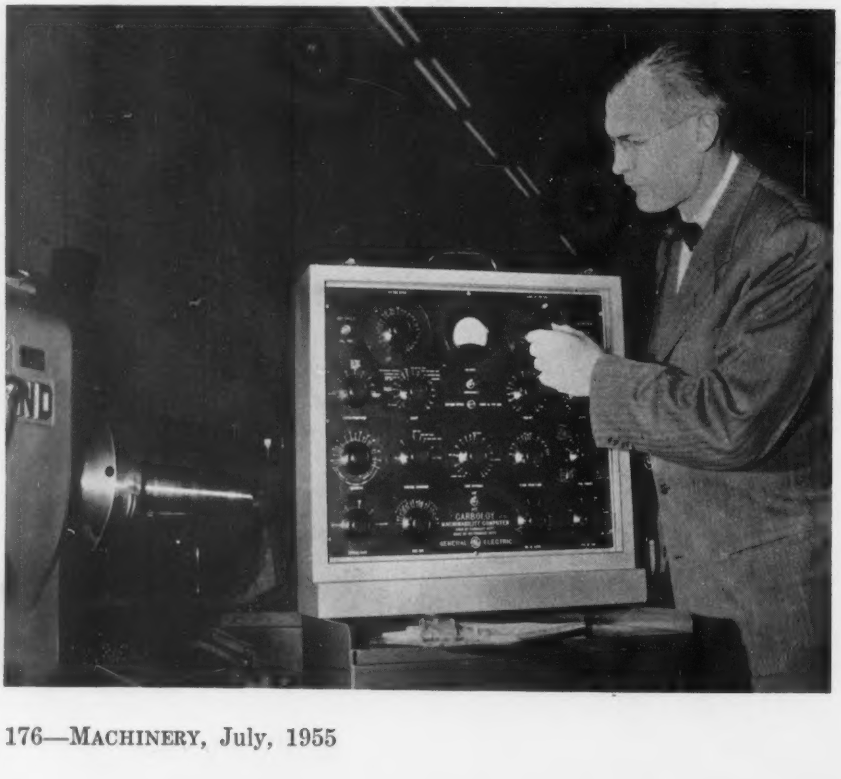
Graduations for the majority of dials are marked in two ways, with descriptive wording and with numerical designations. Wording on the dials facilitates setting for known materials and conditions, while numerals aid in cases where in-between values must be set. The graduations for the "tool profile" adjusting knob take the form of sectional drawings depicting tool profiles in contact with the work.

Information concerning any one of thirteen variables can be fed into the unit, and the fourteenth, or the desired answer, becomes immediately available. The computer will also consider five variables which affect the motor horsepower required to do a machining job. It will yield the value of one variable after being fed with information on the other four. Answers provided by the computer are based on the use of those feeds, depths of cut, proper grades of carbide, and tool geometry which will result in a normal wear type cutting edge failure.

* * *

### Tin Vital to Aircraft

Aircraft materials containing tin include naval brass, red brass, manganese-bronze, phosphor-bronze, silicon-bronze, gun metal, solder, fusible tin alloys, tin plate, tin coatings, and tin-zinc alloy plating. Tin is used in aircraft structures, engines, propellers, oil systems, and electrical, radio, and radar installations, as well as in many other places.



**Portable electronic machinability computer solves complex machining problems in a matter of minutes. Fourteen variable factors relating to the work-piece, tool, and cutting conditions are evaluated by the instrument.**

# INGENIOUS *Mechanisms*

**Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices**

### Winding Head for Skeins of Embroidery Floss

By Ralph T. Stewart, Winston-Salem, N. C.

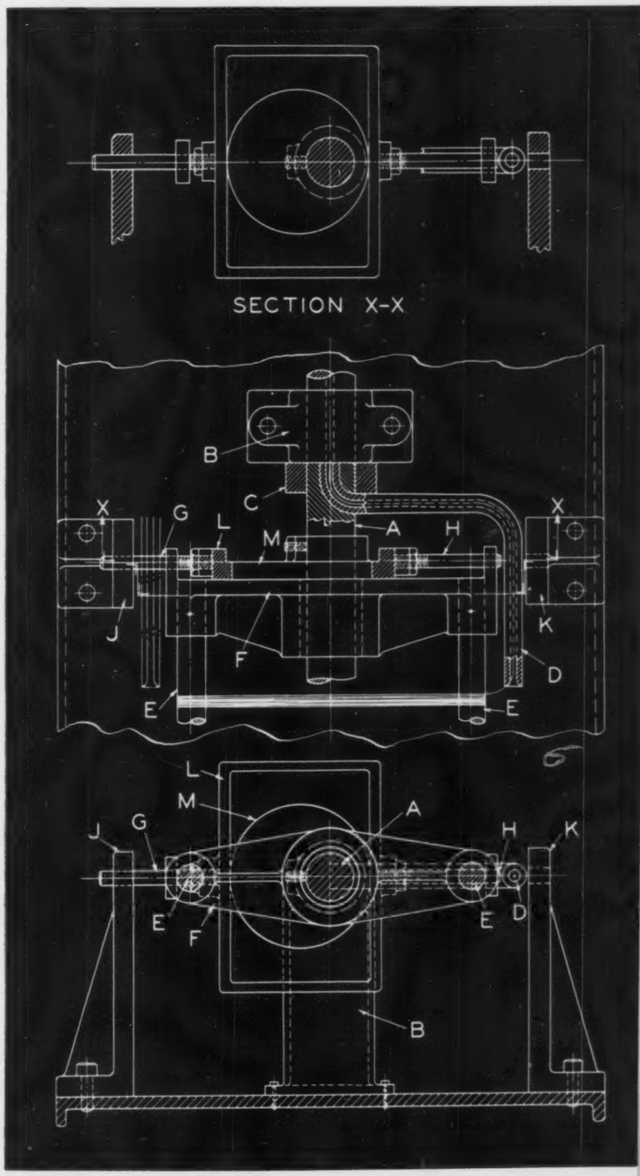
Skeins of embroidery floss are formed by winding the thread around two stationary bars. As each skein is formed, it is moved along the bars, away from the winding head, to be cut and labeled. The path of a winding arm swinging around the outside of the two bars must not be restricted by any type bracket, such as might be required for retaining the bars in a stationary position. The illustrated mechanism, utilizing a Scotch yoke, is being used in such a machine.

Floss to be wound passes through a hole drilled in the center of shaft *A*. The shaft is supported in bearing bracket *B* and is held by collar *C*. From there is continues through hollow winding arm *D*, which seats in the shaft and is brazed in place. The winding arm is revolved at high speed, wrapping the floss about the two stationary arms *E* mounted in bracket *F*.

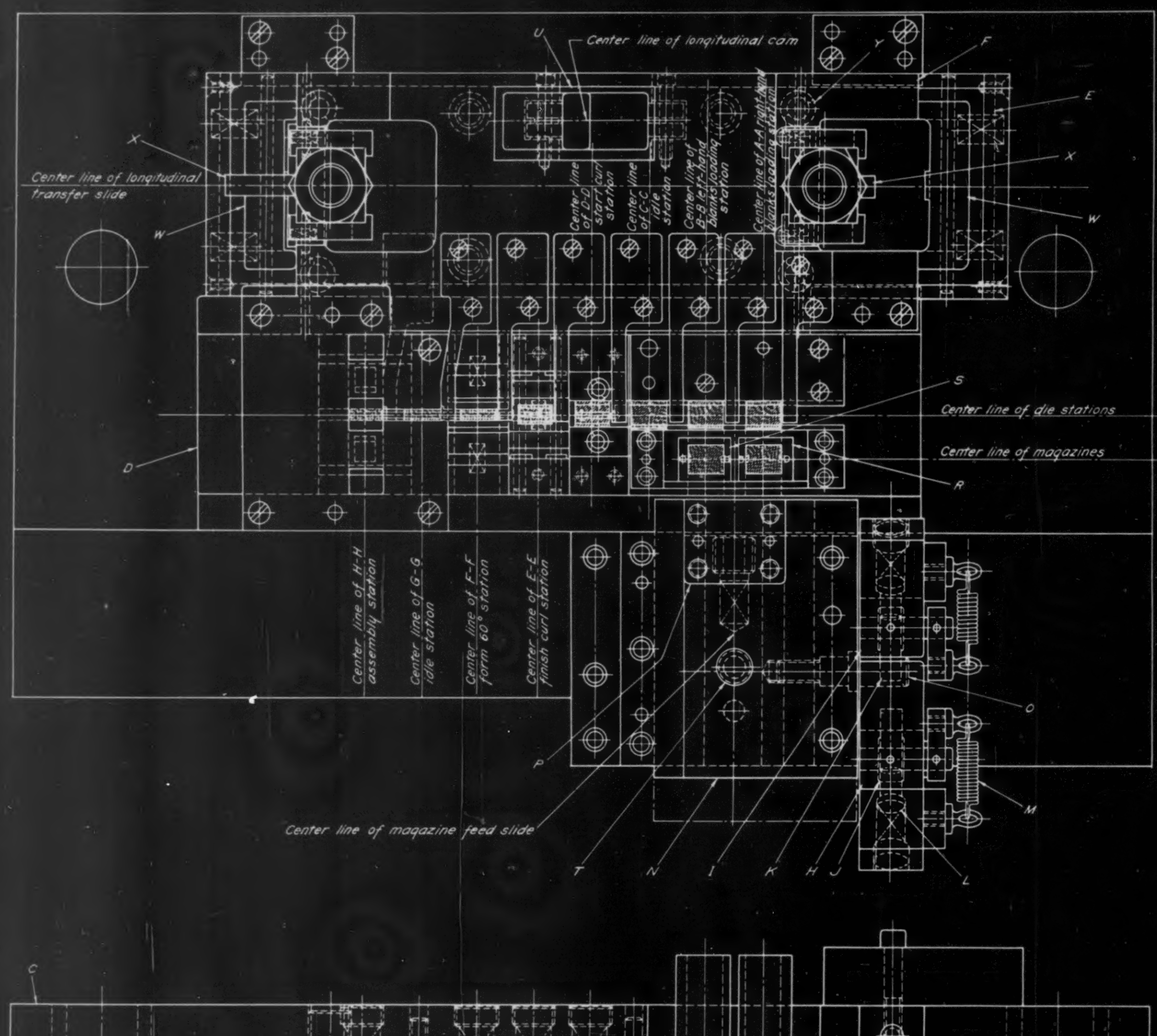
Support for this bracket is obtained from pins *G* and *H*, which are a sliding fit in holes drilled through integral bracket ears. Two identical angle supports *J* and *K*, screwed to the machine base, are drilled to receive the outer ends of the pins. The inner ends of the two pins are threaded into bosses on either side of Scotch yoke *L*. Cam *M*, mounted on shaft *A*, rides within the yoke.

The cam is timed to move pin *G* into engagement with support *J* when the winding arm is passing between bracket *F* and support *K* as illustrated. As the winding arm approaches the left-hand side of the unit, the yoke and attached pins move to the right. This advances pin *H* into engagement with support *K*, while retracting pin *G* from the opposite support. A path is thus opened between bracket *F* and support *J* to permit unrestricted passage of the winding arm.

Bracket *F* is supported at all times. During the time that winding arm *D* is approaching either vertical position, and just after it leaves that position, both pins are engaged simultaneously. The appropriate pin is completely disengaged only during the instant necessary for the winding arm to pass. The relationship of the working members to each other may be more clearly seen in section X-X.




**Head for skein-winding machine features Scotch yoke for reciprocating movable bracket-support pins**


Center line of longitudinal cam
Center line of longitudinal transfer slide
Center line of D-D start curl station
Center line of C-C idle station
Center line of B-B left-hand blanks loading station
Center line of A-A right-hand blanks loading station
Center line of die stations
Center line of magazines
Center line of H-H assembly station
Center line of G-G idle station
Center line of F-F form 60° station
Center line of E-E finish curl station
Center line of magazine feed slide

# Progressive Die Incorporates Intermittent Feed Mechanism

By Charles and David Golosman, Brooklyn, N. Y.

Manufacture of the popular basket-weave chain for watch bands now is simplified by an unusual progressive die. Characteristic flexibility of such a chain, a section of which is illustrated in Fig. 1, is obtained by the hinged joint of each row of links. These rows are alternately left-hand and right-hand.

In a previous operation, the links are stamped flat from coiled strip stock. The die then functions to build the chain by automatically feeding right-hand and left-hand links and curling and interlocking the joint areas. In Fig. 2 is a mechanical drawing of the die. There are two loading stations, *A-A* and *B-B*; three forming stations, *D-D, E-E,* and *F-F;* two idle stations, *C-C* and *G-G;* and one assembly station, *H-H.*

The links advance from station to station by means of a longitudinal transfer slide *E*. Attached to the slide is a floating plate *F* provided

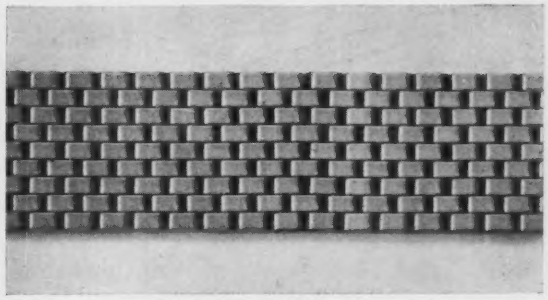
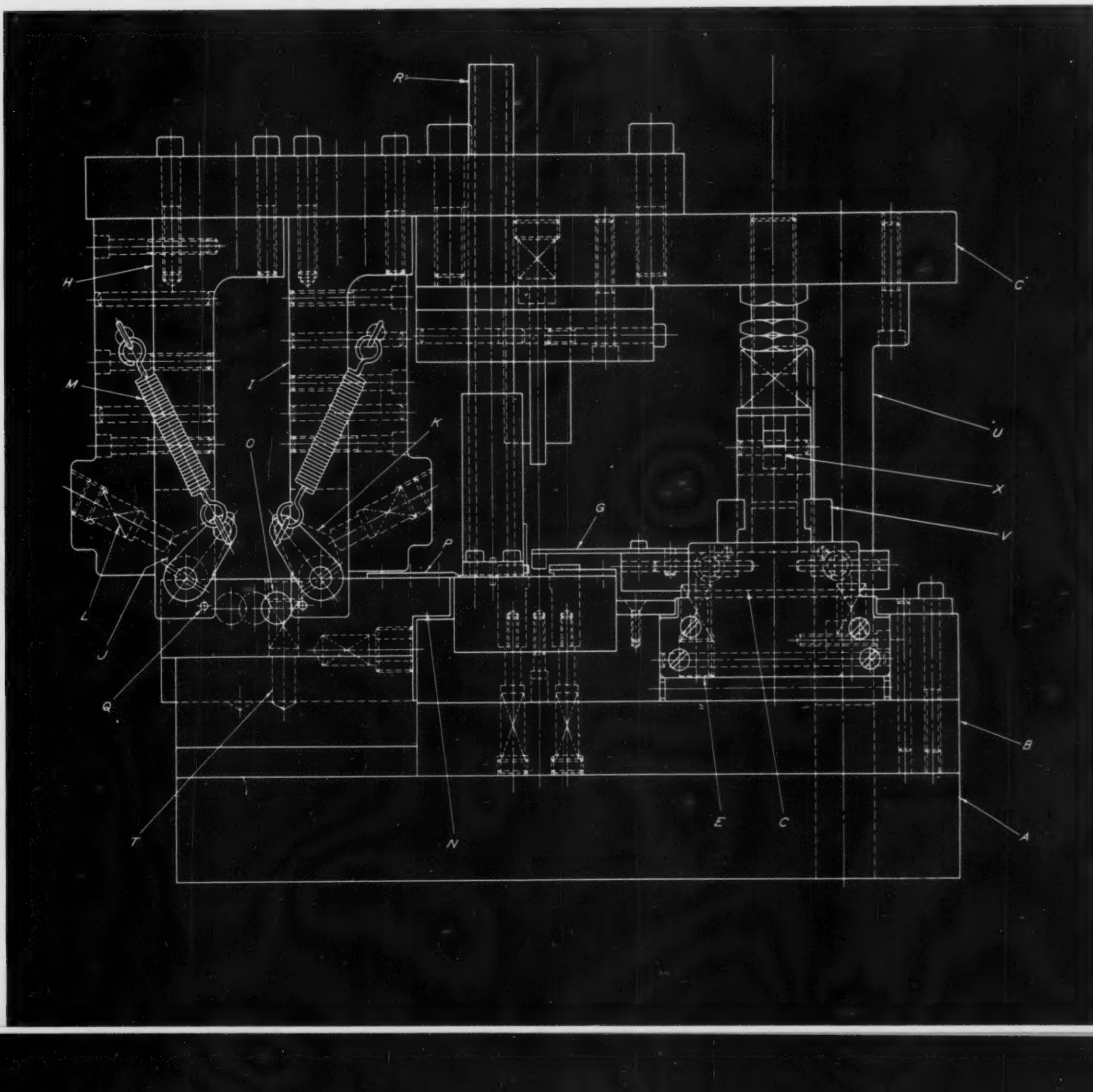


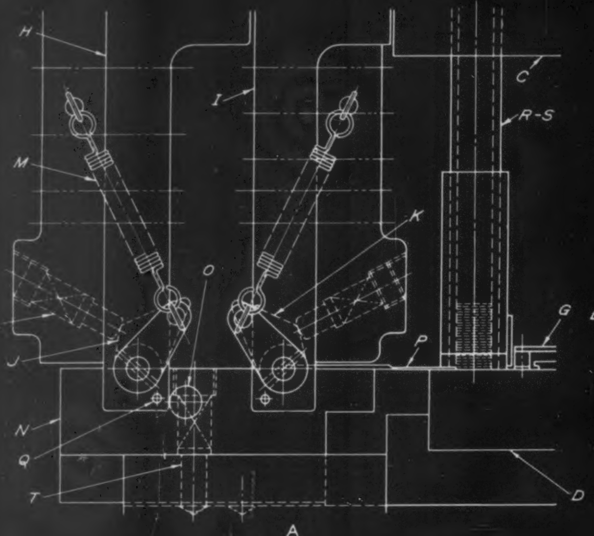
Fig. 1. Basket-weave chain which consists of rows of links with hinged joints

with seven fingers *G*. On the down stroke of the press, prior to the advance of the links, the plate is lowered and locked at the level of the die. The fingers, now set in front of the links, push them to succeeding stations as the transfer slide moves forward. During the return movement of the slide, the plate is released and raised to avoid dragging the links back.

Actuation of the magazine feed mechanism—

Fig. 2. (Opposite page and below) Mechanical drawing of the eight-station progressive die

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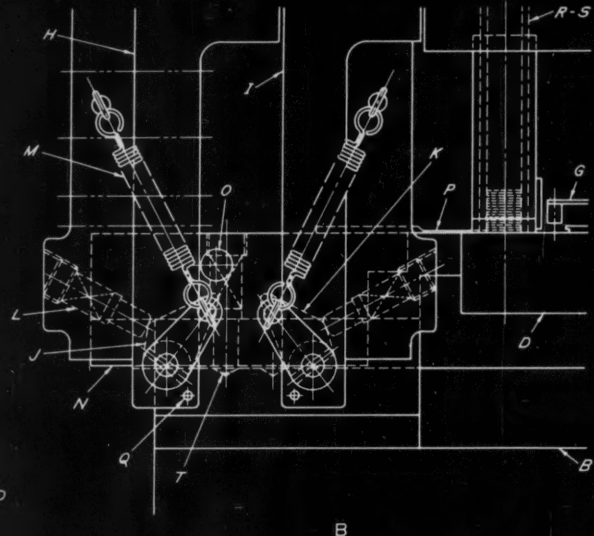
D

A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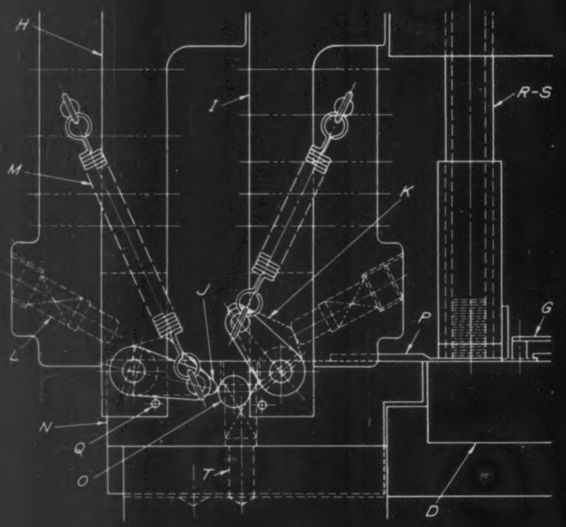
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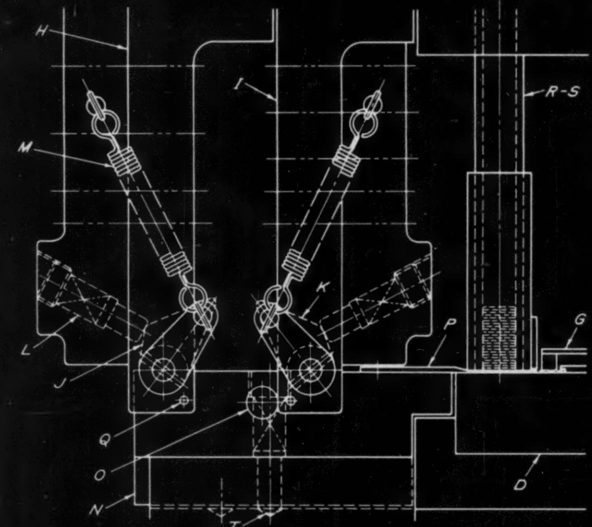
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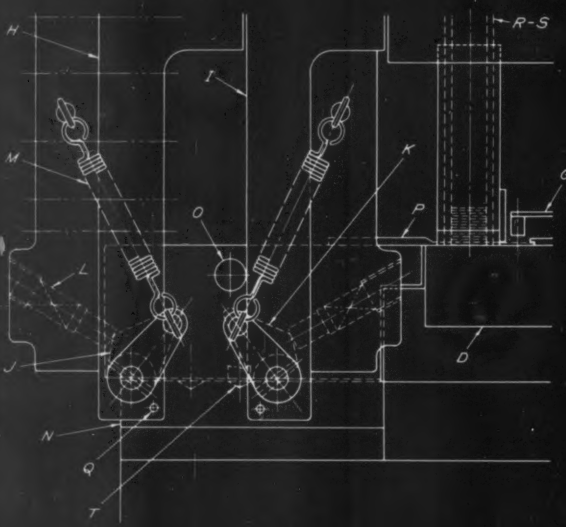
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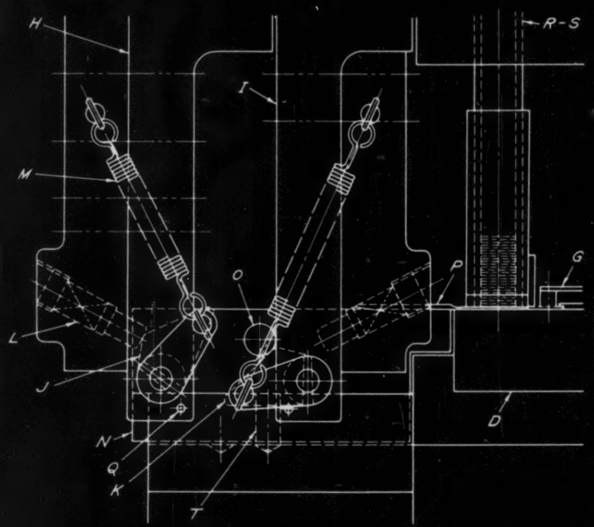
E


H
R-S
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N
Q
K
T
D

F

the unusual feature of the die—is intermittent, being timed to every other up stroke of the press. Right-hand and left-hand links are fed into the loading stations *A-A* and *B-B*, respectively, while these stations are empty, and without interfering with the action of the fingers. There are two magazines: magazine *R* loads station *A-A*, and magazine *S* loads station *B-B*.

A right-hand and a left-hand link are fed simultaneously to the two loading stations with every forward movement of the feed slide *N*, by means of a dual feed blade *P*. The reason the magazine-link loading device is actuated on every other up stroke is because only a single link can be accommodated at the assembly station during any one cycle of the press.

A press having a 2-inch stroke was selected for the job. The complete cycle is as follows: At the start of the down stroke, shoes *V* lower plate *F* to the level of the die, which then is locked to the transfer slide *E* by latches *W*. Next, a 45-degree cam *U* moves the slide forward, and the fingers *G* advance the links from station to station. Near the end of the down stroke, auxiliary cams *X* release plate *F*, and four compression springs *Y* lift it to clear the links in the die, on the return movement of the slide. During the final 3/4 inch of travel on the down stroke, the links rest in their respective stations, and this part of the cycle is utilized for forming and assembling the chain. The feed slide *N* remains inoperative throughout the down stroke.

On the up stroke, the cam *U* returns the transfer slide, plate, and fingers to their original positions. During this part of the cycle the feed slide moves in a forward direction on one up stroke by a swinging cam *J*, and in a reverse direction on each alternate up stroke by another swinging cam *K*.

In Fig. 3 are views of the intermittent feed mechanism at various points in two consecutive cycles of the press. In view A, at the start of the first down stroke, feed slide *N* is away from magazines *R* and *S*, with blade *P* in front of them. Cams *J* and *K* are held in position by balancing tension springs *M* against compression springs *L*, and normally protrude about 5/16 inch from the edges of right-hand bracket *I* and left-hand bracket *H*. Cam *J* on the left-hand bracket is above and close to a stud *O*, while cam *K* on the right-hand bracket is at the same level but about 3/4 inch away from the stud. Both magazines are filled with links, but the loading stations are empty as yet.

At the end of the first down stroke, view B, cam *J* has contacted the stud in passing it, and is forced to swing inside a slot in bracket *H*. However, the feed slide remains stationary, since the comparatively light pressure of spring *L* is balanced by spring *M*. In addition, the feed slide is held in place by the rounded end of a locating pin *T* which is confined under spring pressure. Upon clearing the stud, cam *J* has swung back to its initial position. At the same time, cam *K* clears the stud freely, since it is about 3/4 inch away from it; and longitudinal transfer slide *E*, Fig. 2, is moved forward by cam *U*.

**Fig. 3. (Opposite page) Positions of the feed mechanism during two consecutive cycles of the press**

During the first up stroke, view C, cam *J* is swung down, as soon as it contacts the stud, until it hits a supporting pin *Q*. As cam *J* continues upward, the pressure of its beveled edge on the stud moves the feed slide and blade forward about 3/4 inch. Once the tip of the cam clears the stud, spring *M* returns the cam to its initial position, seen at the end of the first up stroke, view D. Meanwhile, the blade pushes out two blanks, one from each magazine to the two loading stations. The stud has now been moved close to cam *K*. Also during this first up stroke, the transfer slide is returned to its initial position by cam *U*, Fig. 2.

At the end of the second down stroke, view E, cam *K* has duplicated the movements of cam *J* on the first down stroke, and likewise, imparts no movement to the feed slide. However, the transfer slide acts again during this second down stroke; one of its fingers *G* (the second from the right) carries the left-hand link from loading station *B-B*, Fig. 2, to the empty idle station *C-C*, while another finger (the first from the right) carries the right-hand link from loading station *A-A* to *B-B*.

During the second up stroke, view F, cam *K* continues to duplicate the movements of cam *J* on the first up stroke. The feed slide is now returned to its initial position and the blade is brought back in front of the two magazines. Simultaneously, cam *U*, Fig. 2, returns the transfer slide to its starting position.

On the third down stroke, the link in the idle station is advanced to the first forming station *D-D*, and the link in loading station *B-B* to the idle station. (Since the link in loading station *A-A* has previously been moved to *B-B*, both loading stations are now empty. Thus, during the third up stroke, two more links are deposited in the loading stations.)

During each of the subsequent down strokes, right-hand and left-hand links advance from station to station until they reach the assembly station *H-H*, where they are joined together, forming an endless chain which travels down a chute beneath the die.

# TOOL ENGINEERING *Ideas*

**Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work**

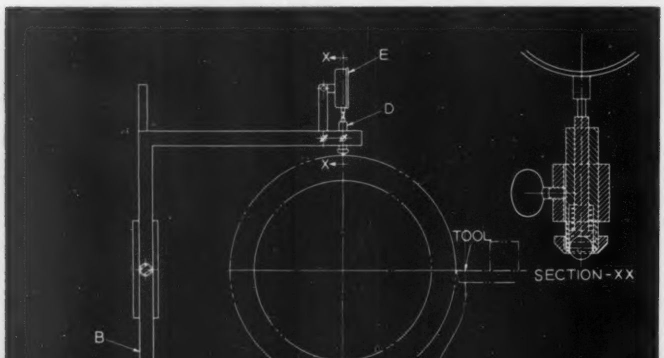
## Automatic Gaging Device for Use in Truing Rolls

By S. F. ALLEN, Machine Shop Superintendent
Libbey-Owens-Ford Glass Co., Ottawa, Ill.

A routine maintenance job in the machine shop, where the writer is superintendent, consists of truing large forming rolls which are used in the manufacture of plate glass. The surface of these rolls must be machined symmetrically. The contour changes along the length of the roll and it is impracticable to use templates for guiding the tools during the turning operations. The Class 2 finish required would be marred if the lathe were stopped to measure the diameter of the work at various points along the contour.

In order to solve the checking problem, a measuring device was developed that is here illustrated. This device consists primarily of an upright support *A*, which is mounted on the lathe carriage. Frame *B* is attached to the upright support in such a manner that the frame can revolve on the support. The frame is of suitable size for spanning the work diametrically. On the lower arm of the frame, there is mounted a ball contact member *C* which touches the work on the under side. The frame is also provided with an upper contact feeler *D* and a dial indicator *E*. The spindle of the dial indicator is in constant contact with the upper end of part *D*. Contact part *C* is held against the under side of the work by counterweight *F*. Details of units *C* and *D* are shown in the illustration in sections Y-Y and X-X, respectively.

As the diameter of the work decreases, the spring in part *D* expands, moving the ball contact down. The indicator spindle follows this downward movement with the result that the operator can readily observe any increase or decrease in the work diameter to 0.001 inch. With this device it is unnecessary for an operator to stop the lathe until a cut has been completed.

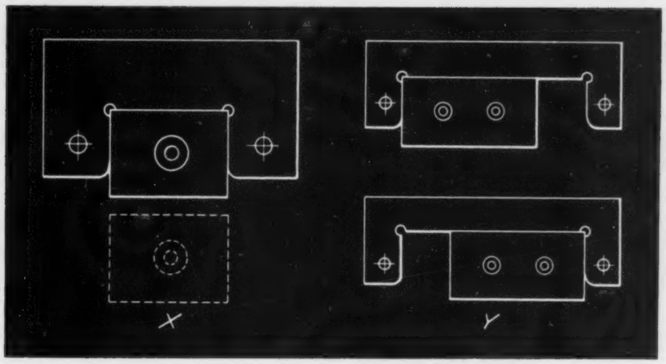



Gaging device designed to facilitate a routine maintenance job in truing large forming rolls used in the manufacture of plate glass

## Locator Plates for Drill Jigs

By FEDERICO STRASSER, Santiago, Chile

When a small drill jig is used it is usually left free on the drill-press table and it is possible to brace the jig manually against the torque




The locator plate affords positive alignment, yet preserves the advantage of having the jig free on the drill-press table.

of the cutter. This practice permits rapid loading and unloading, thus creating shorter work cycles. The jig is positioned on the table so that the hole to be drilled is approximately central with the machine spindle. Alignment is obtained when the drill contacts the chamfer on the jig bushing, causing the jig to float slightly.

However, if the jig or the work-piece is heavy, a slender drill might deflect on entering the jig bushing instead of producing the proper floating action. Complete drill fracture is not uncommon. To avoid this contingency, a simple locator plate can be bolted to the drill-press table when the job is set up.

As can be seen in the accompanying illustration, the plate has a recess in its front edge, in which the drill jig is a close fit. Radii on the outer corners of the sides of the recess smooth the entry of the jig. The plate, of course, is bolted to the table so that the drill-jig bushing is in alignment with the machine spindle.

In view *X* a locator plate is shown with a recess for a one-hole jig. In view *Y*, the locator-plate recess accommodates a two-hole jig, which is banked, in turn, from each of the two sides of the recess.

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## Hydraulically Operated Finger Chuck

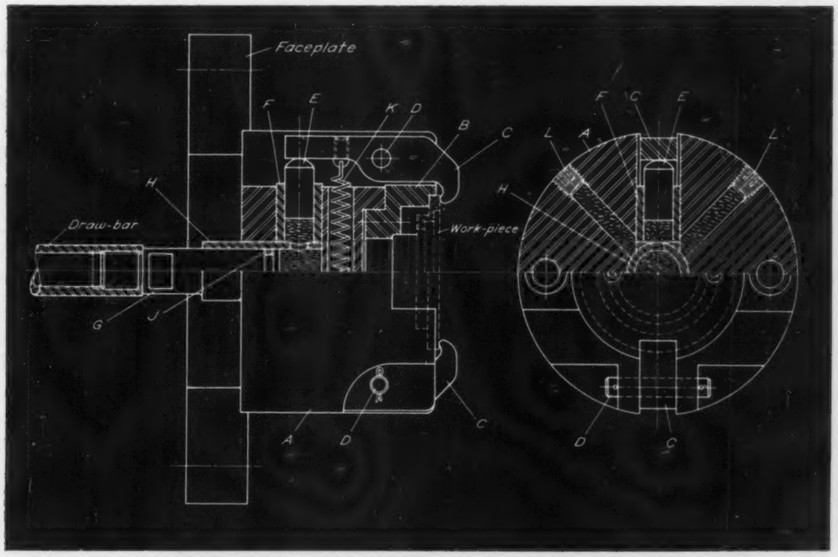
By Samuel Rosen, Lorain, Ohio

A finger chuck, designed for use in boring and grinding operations where close tolerances must be maintained, is shown in the accompanying illustration. A unique feature of this chuck is its method of clamping; it has a self-contained hydraulic system.

Chuck body *A* is drilled and counterbored in two places for mounting on a conventional lathe faceplate. The front face of the chuck is bored and counterbored to receive an adapter *B* which is held in place by two screws. This adapter can be replaced with other adapters so that different work shapes can be accommodated.

The work-piece is locked in the adapter by

Finger chuck, having a self-contained hydraulic system, is actuated by lathe draw-bar.



two clamping fingers $C$ that are mounted in opposing slots in the periphery of the chuck body. These clamping fingers can be interchanged with others to hold different work diameters. Pin-shafts $D$, held in place by cotter-pins at both ends, support the clamping fingers so that they may be pivoted.

Locking motion is imparted to each finger by individual pistons $E$ riding in liners $F$ (only one of each shown). Heavy-weight hydraulic fluid is contained in passages within the chuck body itself. Pressure is applied to the fluid by the advancement of main piston $G$ fitting within cylinder $H$. An "O" ring packing $J$ prevents the bypassing of fluid to the rear of the chuck.

In use, the work-piece is first located in the adapter. Following this, the lathe draw-bar is moved toward the headstock. Main piston $G$, which is threaded into the end of the draw-bar, is consequently forced into cylinder $H$, tending to compress the hydraulic fluid. The increased pressure within the chuck forces both pistons $E$ outward into contact with the under side of the clamping fingers. These fingers, which are pivotally mounted, grip the work-piece tightly.

To release the clamping fingers, the draw-bar is moved away from the lathe headstock, taking the main piston with it. Pressure behind the two smaller pistons is decreased, permitting tension springs $K$ to return the fingers to their original position.

Filling the chuck with hydraulic fluid is accomplished by first withdrawing piston $G$ to its rearward limit of travel. With both plugs $L$ removed, fluid may be funneled into one opening while the other opening serves as an air bleed. After the plugs have been replaced, the unit is ready for use.

## Adjustable Locator and Floating Clamp for Piercing Operation

By Cliff Bossmann, Dayton, Ohio

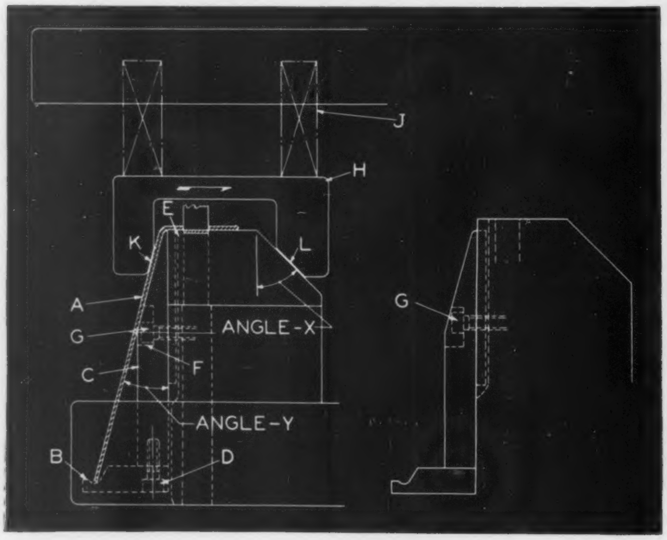
An adjustable work locator and a floating clamp are novel features of the piercing die shown at the left in the accompanying illustration. In piercing a hole in the short, top-section of the bent shape $A$, it is important to maintain an accurate relationship between the hole and the long, inclined leg. Obviously, it was necessary to design the die so that the part was located from the leg.

If the locating means were integral with the die-block, necessary periodic regrindings of the top of the die would soon destroy the close relationship between the hole and the leg. Such an eventuality is avoided by the adjustable locator. This is an L-shaped member, formed by a base piece $B$ and an upright $C$, which are joined by cap-screw $D$. The bottom of the leg is nested in a lip in the base, and the upper part of the leg rests against an inclined surface of the upright. The end of this member is flush with the top of the die.

The upright is a sliding fit in a channel $E$ in the adjacent side of the die. There is a counterbored slot $F$ in the upright, containing a cap-screw $G$ which secures the upright to the die.

To regrind the top of the die, the locator is temporarily lowered, as seen at the right in the illustration. It can then be adjusted so that the upright is again flush with the top of the die.

The floating clamp $H$, attached to the punch assembly, has the shape of a horseshoe, and automatically acts to retain the work in position as the press ram descends. To do this, the clamp is held by compression springs $J$ and has two angular surfaces $K$ and $L$, which correspond to the incline of the upright and to another incline on the rear of the die. Since angle $x$ is greater than angle $y$, the tendency is for the clamp to move transversely in the direction of the arrow, thus fixing the leg of the part against the upright.




To grind the top of the die, cap-screw G is loosened and the locator is lowered.

# Hydraulic Conference Deals with Fabricating Machinery Problems

MANUFACTURERS and users of hydraulic presses, welding, die-casting, and plastic-molding machinery, as well as fluid suppliers and hydraulic accessory producers, participated recently in a successful hydraulic conference held in Detroit, Mich. Sponsored by Vickers Incorporated, this First Fabricating Machinery Hydraulic Conference was patterned after the one Machine Tool Forum and the four Transport Aircraft Hydraulic Conferences held in previous years, but this was the largest one undertaken to date.

The Conference served as a clinic for exchanging ideas and developing information leading toward reduced operating costs and improvement in hydraulic product and system design. Sessions were primarily of the audience participation type, with open forum discussions based on an agenda prepared from questions submitted by the participants in advance. The Conference was attended by nearly 150 design, maintenance, and service engineers, representing eighty-eight manufacturers and users of fabricating machinery and fifteen suppliers of hydraulic components and materials.

Keynote speaker for the Conference was D. J. Davis, vice-president—manufacturing, Ford Motor Co., Dearborn, Mich. Mr. Davis discussed the increasingly important role being played by hydraulics in industry. In the field of fabricating machinery and equipment, he cited the development of a concept which is based on the premise that it is more economical to displace metal than to remove metal. This concept has prompted recent developments in die-casting, rolling, powdered metal, extrusion, stamping, welding, and other processes.

Present and foreseeable needs noted by Mr. Davis included increased productivity to meet competition, higher skilled workmen, reduction of down time, hydraulic feed controls unaffected by temperature changes, simplified controls, and good low-cost, fire-resistant fluids. He also stressed the need for further standardization, and improvements in sealing and piping to minimize leaks.

Discussion during the Conference was ably directed by co-moderators Royal E. Russell, master mechanic of Chrysler Corporation's 9 Mile Road press plant in Detroit, Mich., and Adolphe J. de Matteo, chief engineer for Watson-Stillman Co., Division of H. K. Porter Co., Inc., Roselle, N. J.

Under the general subject of circuit and system problems, the relative merits of a closed cir-

**Speakers and co-moderators at the Vickers-sponsored First Fabricating Machinery Hydraulic Conference. J. F. Forster (standing at left), vice-president and assistant general manager of Vickers Incorporated. D. J. Davis (seated at right), vice-president—manufacturing, Ford Motor Co., was keynote speaker. Co-moderators at the Conference were R. E. Russell (seated at left), master mechanic of Chrysler Corporation's 9 Mile Road press plant; and A. J. de Matteo (standing at right), chief engineer for Watson-Stillman Co.**

cuit with reversing pump or a unidirectional pump with external control valves for hydraulic press service were discussed. It was pointed out that each specific application must be studied before a choice can be made. With a reversing pump there is less decompression and shock, and less piping is required, thus decreasing possible leakage. Also, higher pressures can be employed.

### *Pressure to be Used Depends on Specific Application*

In discussing the pressures to be used in hydraulic systems and equipment, it was pointed out that both high and low pressures are necessary. Many representatives stated their preference for low or medium pressures (up to 1500 pounds per square inch) because of the added hazards and increased leakage problems encountered with high pressures (2000 pounds per square inch or more). However, high pressures are necessary where space is a limiting factor, large volumes of fluid must be moved, or fast speeds are required. The use of O-rings and properly designed flange fittings have done much to eliminate leakage when using high pressures.

The importance of adhering to J.I.C. standards in the manufacture of fabricating machines was emphasized by a representative of Ford Motor Co. Violations have made maintenance difficult due to ease of contamination, leakage caused by unsupported piping, lack of identification on parts, poor planning in piping lay-outs, and omission of control manifolding. The need was stressed for interchangeability with regard to size and location of ports, as well as mounting pad configurations and dimensions.

In that portion of the Conference devoted to pump and valve design, a Vickers representative recommended that high viscosity fluids having a flat viscosity curve be employed with pressure-compensated flow-control valves. Also, some means of fluid temperature control should be provided to maintain even viscosity.

A question about the effect of excessive heat on hydraulic mineral-base liquids was answered by the comment that the fluids will thin-out (reducing their viscosity), and oxidize, causing sludge and varnish formation. Premium oils with inhibitors are available when high temperatures are necessary. A representative of one fabricating machinery user outlined his company's method of determining when hydraulic oil has deteriorated sufficiently to be replaced. This method consists of taking periodic samples from each machine (with an average of ten samples a day), and checking the amount of dirt, water, or coolant contamination, and the neutralization number against pre-set standards. Periods of time before the oils must be replaced vary from three months to three years, depending on the applications and designs of the machines.

### *Various Types of Fire-Resistant Fluids Discussed*

Two basic types of fire-resistant fluids (the straight synthetic and water-base types) were reported to be showing great promise. A third type, soluble oil emulsions, is still considered in the experimental stages. However, present indications are that the oil-in-water and water-in-oil emulsions will probably be limited in their applications to working pressures below 300 pounds per square inch to insure satisfactory performance. One user reported fair results with a water-soluble type, fire-resistant fluid in a hydraulic welding machine in the 300- to 400-pound-per-square-inch operating range.

Mention was made of a school conducted by Vickers to assist in the special training required by customer personnel in hydraulics maintenance. A two-week course is offered every month, with the exception of July and August. Each course consists of 60 per cent classroom and 40 per cent laboratory work.

An interesting highlight of the Conference was the first public announcement that one of the leading automobile manufacturers had taken the initiative in establishing its own standard dimensions, tolerances, and construction features for the manufacture of oil-hydraulic cylinders. This program, begun one and one-half years ago, is aimed at improving cylinder life as well as producing dimensional interchangeability. Included in the dimensional standards are rod diameters, rod thread sizes and lengths, port sizes, five types of mountings, and maximum cylinder envelopes.

During the discussion of how to design and build hydraulically actuated fabricating machinery with leakproof joints, it was brought out that one large press manufacturer successfully welds pipe to flanged connections to produce a non-leaking joint. This company peens the welds while they are still hot. A pickling operation following welding removes any scale which may have formed on the inside diameters of the pipe during welding. Also, piping runs are thoroughly stress-relieved after welding. This can be done in position on the machine by ring-heating each pipe in two different locations. Silver-soldered or brazed joints were also cited as good methods of controlling piping leaks. Induction heating was recommended as an ideal method of accomplishing soldering with minimum distortion.

# High-Temperature Coatings Now Sprayed on with Sintered Rods

PURE oxide coatings that are applied with an oxy-acetylene spray gun provide a new means of protecting base materials against extremely high temperatures and erosion. These coatings, developed and produced by Norton Co., Worcester, Mass., find immediate application in rocket engines, for nozzles, tube linings, and thermal barriers. They also show exceptional promise for the skin, vanes, and motor components of guided missiles, for tailpipe linings of ram jets, as well as for various parts of gas turbines, such as inner combustion chamber linings, cross-fire tube linings, flap nozzles, and housing and shroud rings.

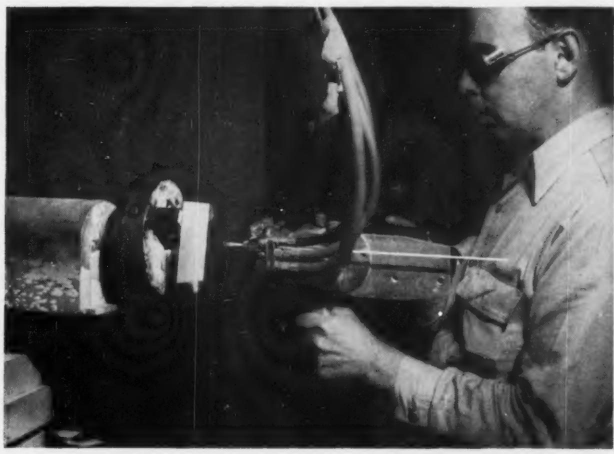
The coating is made in the form of sintered rod 2 feet in length. Three kinds are available: Rokide A (alumina), Rokide ZS (zircon), and Rokide Z (zirconium). In the process, the rod is heated as it is fed centrally through the spray gun. The rod becomes molten in the luminous white cone of the burning gas. Small particles are discharged at high velocity by the air blast, and strike the surface to be coated while still in a plastic condition. Adherence, which is largely mechanical, is aided by preparatory roughening of the base material by an abrasive blasting operation.

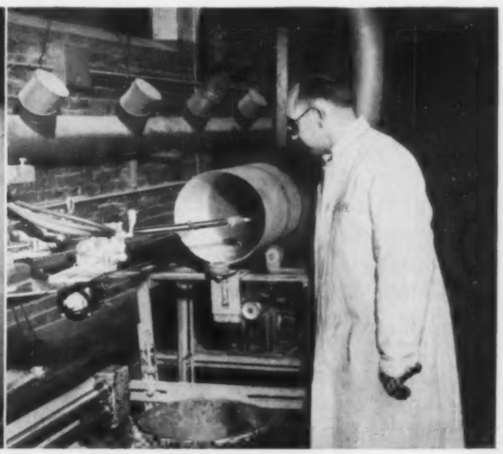
Compared to stainless steel, the coatings show considerably less thermal expansion and thermal conductivity. Melting points of Rokides A, ZS, and Z are, respectively, 3600, 3000, and 4500 degrees F., and they have Knoop hardness values of 2000, 1000, and 750. (Stainless steel melts at 2600 degrees F., and has a Knoop hardness value of 400.) Coating thickness can be applied in the range of 0.005 to 0.100 inch, and accurately controlled. The gun, an adaptation of those used in metal-wire spraying, contains three spring-loaded carbide balls which centralize the rod and produce sufficient drag so that large sections of the rod will not be expelled or repelled by the gas pressure. In addition to high melting points and low thermal conductivity, the coatings are inert to attack by most chemical agents, and are stable in combustion atmospheres, so that they reduce corrosion of metal parts.

Norton is issuing non-exclusive licenses for applying the coatings. There is no charge for the license, payment being made in the form of a royalty based on the weight of the rod consumed.

A parallel development is Rokide C, a silicon carbide coating which raises the surface hardness and oxidation resistance of graphite-base material. This coating is applied by the reaction of the outer graphite surface to vapors from boiling silica sand to form silicon carbide. In this manner, the surface of the base material is transformed to a strongly adherent silicon carbide coating.

**(Left) Applying Rokide A with a spray gun to a flat surface. Even distribution is obtained by revolving the work. (Right) Guns have been developed for internal work, such as coating the bore of this tube. By mounting the gun rig on a lathe carriage, the feed of the lathe is utilized to advance the gun along the bore.**





# Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

## Sales Compensation

EVALUATING sales performance and rewarding sales engineers fairly is a "must" for each sales manager. "Work out a good formula and let that do the trick," one merchandising salesman tells us. But formulas and systems, though desirable, cannot alone determine the value of a sales engineer. Furthermore, formulas and systems may become difficult to interpret and costly to administer. One company uses six factors to arrive at a salesman's bonus. No system can fully replace human judgment fairly applied.

Everyone is familiar with two methods of compensation—only salary at one extreme, and only commission at the other. In between there are numerous schemes on which to base the salesman's "dollar take."

Pause to consider what the sales engineer, when selling machinery direct, is paid for:

Producing a volume of desirable business.

Representing the company in all its services.

Developing new sources of business.

Assisting and cooperating with fellow sales engineers.

Exercising care in spending money.

Furnishing headquarters with new ideas such as product application improvement.

Following the installation, responding to complaints, and occasionally performing services unrelated to sales.

Several such duties do not permit the use of an exact formula for pay. Certainly, loyalty cannot be measured in figures. Besides, uncontrollable factors enter into the picture, such as large unanticipated orders, or losses due to the closing of a local plant owned by a nation wide corporation.

Examine the five elements that may enter into the sales engineer's total remuneration:

Salary;
Commission on volume sales;
Bonus incentives for extra effort;
Profit sharing; and
Company benefits.

*Salary* is of greatest importance in the case of machinery selling. Sales engineers are an integral part of the company's key personnel. Their connection must have a high degree of stability. They are expected to exercise careful judgment in making sales, rather than to book many orders willy-nilly.

*Commission*, a form of incentive, may apply to total sales, or more often, to sales beyond the quota. It may be related also to salesmen's expenses, and decreased on large "windfall" orders. The weakness of an unusually large compensation commission is that the salesman tends to become an order grabber rather than a business builder.

*Bonus*, though closely related to commission, usually measures extra effort. It might apply to various types of sales performance such as obtaining business from new customers or selling all products in a given line.

*Profit Sharing* is increasingly popular as an auxiliary means of compensation. Payment, however, must be in accord with a company plan that applies to all company employes, or to a group of key men. Any profit sharing plan is calculated to make employes profit and expense conscious. Its weakness is that one's individual share is small, and liable to be taken as a matter of course.

*Company Benefits*, such as pensions, insurance and sickness benefits, represent a real company outlay that no sales engineer should ignore. They lead to establishing permanence between the employe and his company. Each sales manager should know what these benefits cost, and explain them to the salesman.

Too often the individual's yearly sales quota is based only on past annual sales and ignores sales opportunity. Market research is required to discover the potential business of any territory or customer group. Fair quotas can be based on past performance, sales opportunity, and anticipated business conditions.

For the smaller equipment builder, a simple method of determining compensation is desirable. Aside from profit sharing and company benefits, salary, of course, comes first. It should be based on intelligent and cooperative performance, prog-

ress in relation to possibilities, and changes in the cost of living. Length of service alone is no reasonable basis for increased remuneration.

Beyond salary, a commission or bonus can well apply to sales volume that exceeds the annual quota. Since important unexpected orders may fall to the lot of the sales engineer, the percentage formula can provide for a decrease as volume ascends. Besides an adequate plan of compensation, nothing is more important than its proper administration.

There are many instances when the sales engineer becomes dissatisfied with his income and secretly decides to make a change in position. The wise sales manager periodically discusses sales performance with each of his sales engineers. He should take the initiative in discussing compensation and express a constant desire for each sales engineer to advance and earn more. He should establish a point system by which he can judge the effort and progress of each sales engineer, and use it as a guide to salary compensation. It should be used to measure the usefulness of the man, and also to strengthen him.

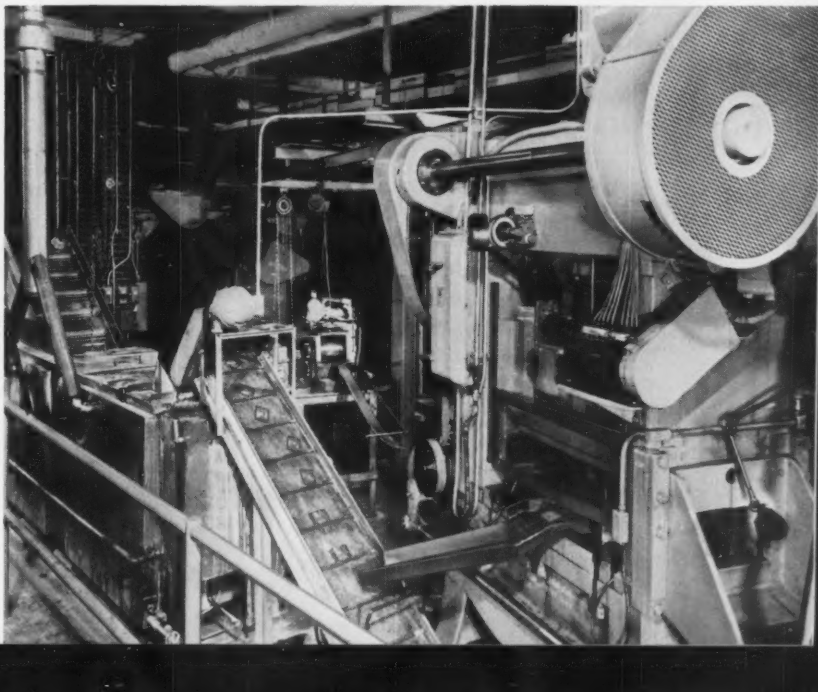
## Complete Stamping Line Requires Only One Operator

Employment of automatic devices and conveyors makes it possible for Signode Steel Strapping Co., Chicago, Ill, to use only one man to attend an entire manufacturing line. This line produces six stamped steel plates used by shippers to secure steel strapping to walls and floors of freight cars. Operations in the line include stamping, counting, degreasing, blast cleaning, and packaging.

Coiled steel strip stock, 6 inches wide by 0.125 inch thick, passes through an automatic 100-ton Bliss press, seen at the right in the accompanying illustration, for blanking and forming. Formed plates drop on a conveyor that carries them to the degreasing tank. Detergent solution in this tank is mechanically agitated and kept near boiling point by thermostatically controlled gas burners.

A second conveyor carries the washed pieces out of the degreasing tank. They drain and dry of their own heat on a third conveyor, a horizontal chain belt, and then they drop into an accumulator pan.

The next step in the process is automatic shot blasting in a tumble-blast unit made by American Wheelabrator & Equipment Corporation, Mishawaka, Ind. This removes burrs left around the edges and holes of the pieces. It also dulls all sharp edges, and provides a satin-matte finish. All but one of the stampings are blasted in loads of 500 pieces and that one piece is blasted in loads of 1000. This is possible because all loads are counted by a mechanism on the punch press. The press stops for thirty seconds after each group of 500 pieces, while the conveyors keep moving. A timer on the accumulator pan keeps the quantities separate and, at the right time, automatically drops each set of 500 pieces into a bucket loader for the shot blaster. The operator controls the loader electrically, and the machine unloads itself into a shipping box when a button is pressed.



**Stampings from 100-ton press (right) are carried by conveyors into and out of degreasing tank (left) before they are automatically shot blasted.**

# LATEST DEVELOPMENTS IN *Shop*

## High-Speed Automatic Screw Machine

The Brown & Sharpe Mfg. Co., Providence, R. I., has announced a new No. 00 automatic screw machine which is capable of exceptionally fast operation. This machine will take stock up to 1/2 inch in diameter and has a length-turning capacity of 1 inch which can be increased to 1 1/2 inches through the use of special equipment. Spindle speeds of 7200 R.P.M. are available to give increased production on all materials from free-cutting plastics to tough alloy steels.

Rigid construction is employed to enable carbide tooling to be used to advantage on many jobs. It is claimed that this machine will produce parts to closer tolerances than any preceding model of its type. Push-button control and other features are provided to materially shorten set-up time and reduce operator supervision while a job is in progress. Cross-slides and detachable ways of hardened and ground steel, precision ball bearings in spindle and sprockets, and fully automatic lubrication are features designed to reduce maintenance problems to a minimum.

The vertical slide is standard equipment which makes an additional tool position available. The spindle speed range from 7200 to 34 R.P.M., with 208 combinations of high- and low-speeds in ratios from 2.3 to 1 up to 16 to 1, permits high cutting efficiency on the widest variety of materials and work diameters. Selection of speeds and the direction of rotation are made by means of simple pick-off gears. Positive chain drive of the spindle at all speeds assures adequate power throughout the full speed range.

The conveniently located control post provides for push-button operation of both the spindle and the driving shaft. A driving-shaft "jog" button is particularly useful when setting up the machine. The speed of the driving shaft (either 240 or 120 R.P.M.), which drives all of the automatic mechanisms, is changed by transposing two pick-off gears. All belts have been eliminated and a safety device prevents rotation in the wrong direction. Eleven change-gears give the complete range of 120 production rates from 3/4 to 100 seconds per piece.

The driving-shaft handwheel does not rotate when the machine is in operation and moves out of the way with the compartment door when gears are being changed. The automatically lubri-


Fig. 1. Brown & Sharpe No. 00 automatic screw machine for high-speed production of small precision parts

# Equipment

## Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

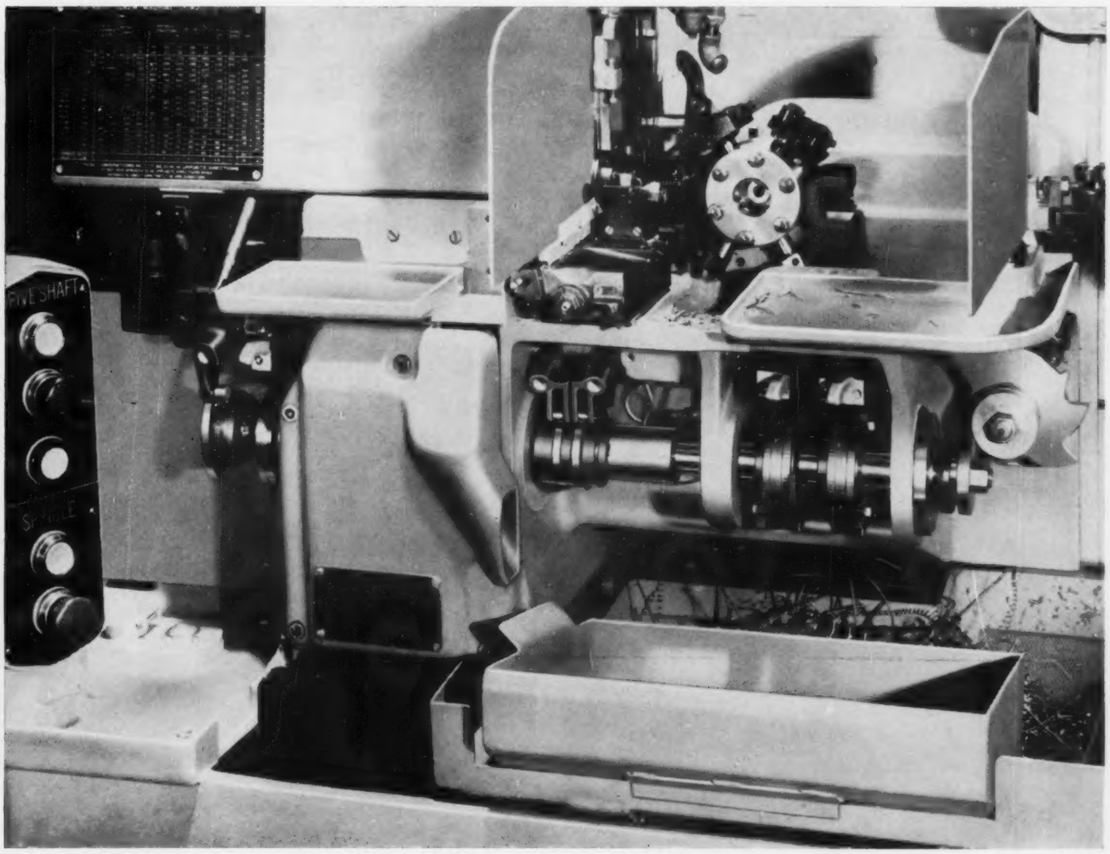
Edited by FREEMAN C. DUSTON

cated turret-slide has a hand-lever for operating convenience when setting up. The coolant supply is constant at both of the driving-shaft speeds and excellent guarding with windows is provided around the work area. The large chip tray is readily removed and a wide trough facilitates raking out chips while the machine is running. Electrical controls conform to J.I.C. standards.

In addition to the many attachments available for previous Brown & Sharpe automatics, two new attachments can be had for the new No. 00 machine. These are the skip-indexing attachment which gives greatly increased production on deep drilling operations, and a brake which acts in the neutral position so that both high and low speeds can be used on those jobs for which provision must be made to automatically stop the spindle.

The spindle is chain-driven by a 3-H.P. constant-speed motor. It is mounted on pre-loaded precision ball bearings and is reversible. The hole through the spindle is 11/16 inch in diameter. The complete spindle assembly unit can be easily removed from the machine for servicing or adjustment. Stock is held in the automatically oper-

Fig. 2. Close-up view of tool turret, vertical and horizontal cross-slides, and slide-cams of machine illustrated in Fig. 1



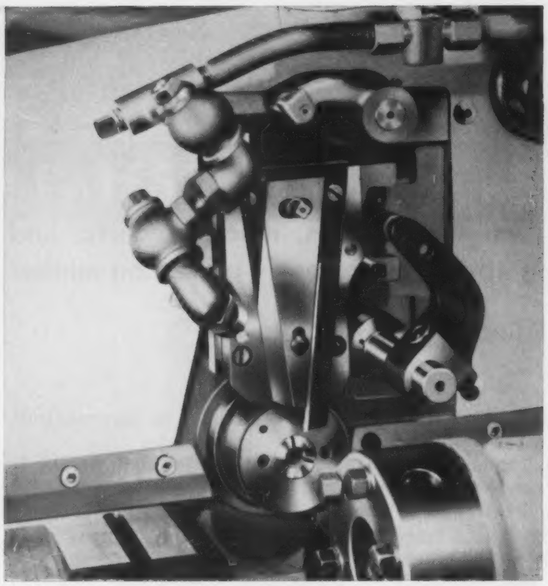


Fig. 3. Vertical slide with quick-acting tool clamp furnished on new B & S automatic

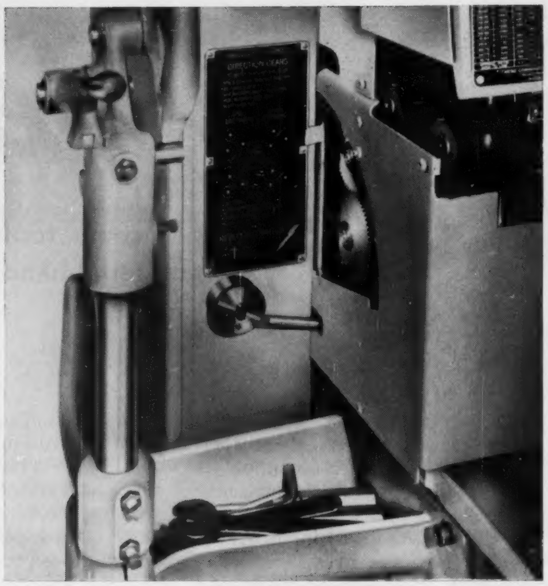


Fig. 4. Arrangement of the drive-shaft gearing of Brown & Sharpe automatic shown in Fig. 1

ated spring collet by gripping power which can be easily adjusted.

Stock is advanced automatically and controlled by a trip-dog, one operating cycle feeding any length up to one inch with a drive-shaft speed of 240 R.P.M., and up to two inches with a drive-shaft speed of 120 R.P.M. The time required for the operating cycle with the 240-R.P.M. drive-shaft speed is one-fourth second.

The hardened and ground steel cross-slides are mounted on hardened and ground detachable steel ways. They are controlled by individual cams and their transverse adjustment is indicated on a dial graduated to 0.001 inch. Provision is made for hand operation when setting up. Adjustable positive stops are provided for the cross-slides and for the vertical slide which is cam-operated.

The turret revolves in a vertical plane and is provided with holes for six tools. It slides on hardened and ground detachable steel ways. The tool holes are 5/8 inch in diameter. Feed for the turret-slide is controlled by a cam. The reservoir for the automatic lubrication system provided for this machine has a capacity of 3 gallons.

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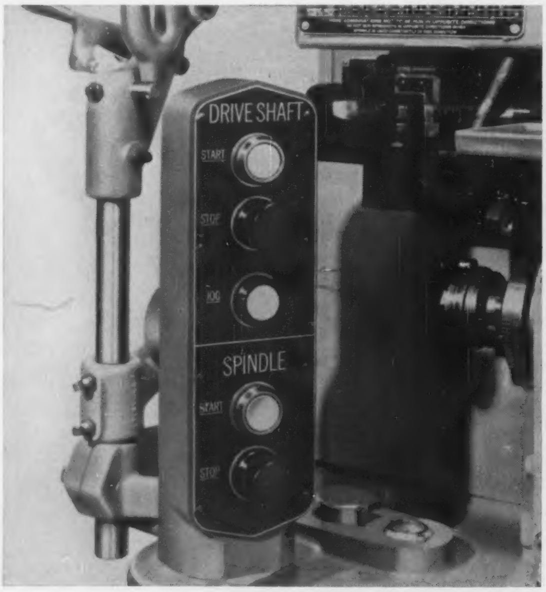



Fig. 5. Close-up of conveniently located push-button control panel on machine shown in Fig. 1

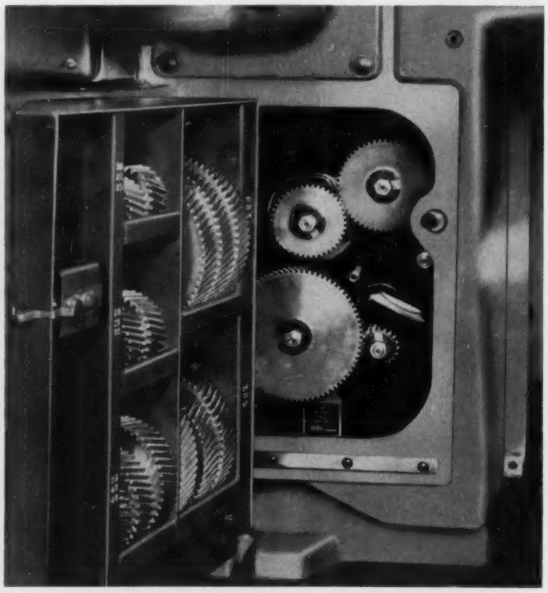
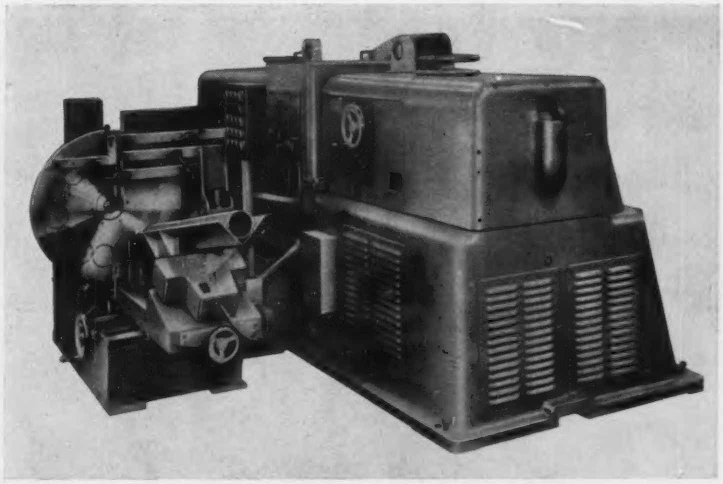


Fig. 6. Storage door in base of machine opened to show pick-off gears for changing spindle speed

## Besly-Welles Double-Spindle Grinder



Double-spindle horizontal grinder announced by Besly-Welles Corporation

A Model 240 grinder of the horizontal double-spindle type just announced by the Besly-Welles Corporation, Beloit, Wis., will be exhibited for the first time at the Machine Tool Show in September. This machine incorporates Besly's "Sealed Spindle Quill" construction and is built to turn out highly accurate work at a high production rate. The grinder heads are completely sealed to eliminate wear and are designed to permit smooth, accurate adjustment of the abrasive discs and to avoid transmitting motor vibration.

All controls, motors, starters, and hydraulic units are enclosed within the rugged streamline machine base. Controls are automatic and are accessible from either side of the grinder. Individual dressers for each disc are push-button operated. It is claimed that this grinder has reduced down time, the time used for dressing, disc changing and set-up to one-third of that previously required. High-speed feeding is achieved through a simple electro-magnetic pick-off disc which supplies work to the grinder in a continuous stream.

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## Millholland Fixed-Center Automatic Boring Machine

A 3B automatic horizontal boring machine of the fixed-center type designed for short-run production work has been introduced by the W. K. Millholland Machinery Co., Inc. Indianapolis, Ind. The table of this machine is arranged to take fixtures which locate the work for the boring operation.

The machine can be operated by push-button when arranged for pre-set automatic cycle functioning, or it can be manually controlled by means of separate push-buttons which actuate the rapid advance, coarse feed, fine feed, dwell, and rapid return movements. When the pre-set automatic cycle is employed, the speeds, feeds, and stroke can be varied to suit the part being bored. The 5- to 10-H.P. boring unit has a spindle 3 inches in diameter with a No. 5 Morse taper. Spindle speeds from 33 to 500 R.P.M. are obtained by means of pick-off gears. The spindle stroke is 10 inches.

Changes of feed during the automatic cycle are controlled by means of adjustable dogs which contact limit switches. The positive stop switch actuates a solenoid which in turn causes a rotary stop mounted on the lead-screw to function. This rotary positive stop is adjustable in increments of approximately 0.001 inch.

A pressure system, operating in a reservoir in the main casting, lubricates the spindle reduction drive and bearings. Other points are lubricated through Alemite fittings. The feed mechanism, operated by a hydraulic pump and fluid motor, furnishes infinitely variable feed rates.

Cycle adjustments within the available range are furnished by a system of valves and piping. The pump serves a two-pressure system with an automatic unloading valve and is mounted on a tank apart from the machine. The rotary fluid motor is of the multiple-piston constant-displacement type.

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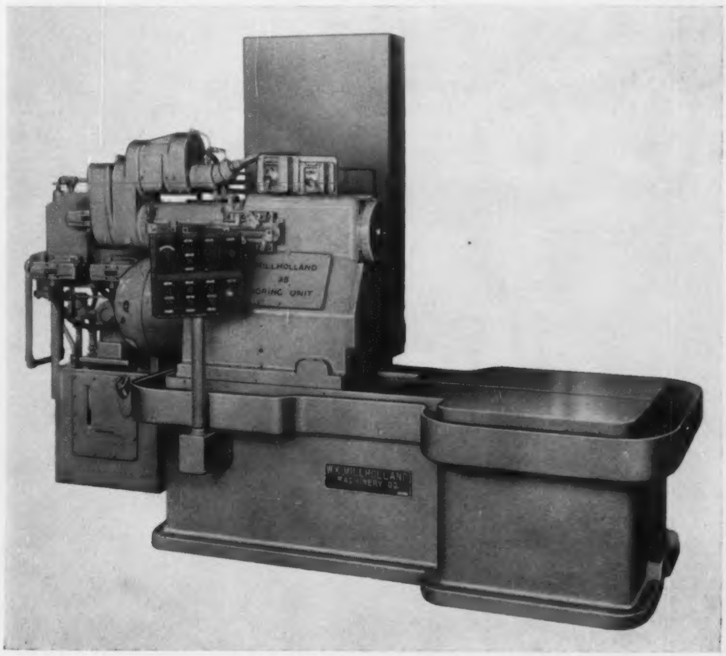



Millholland fixed-center automatic boring machine

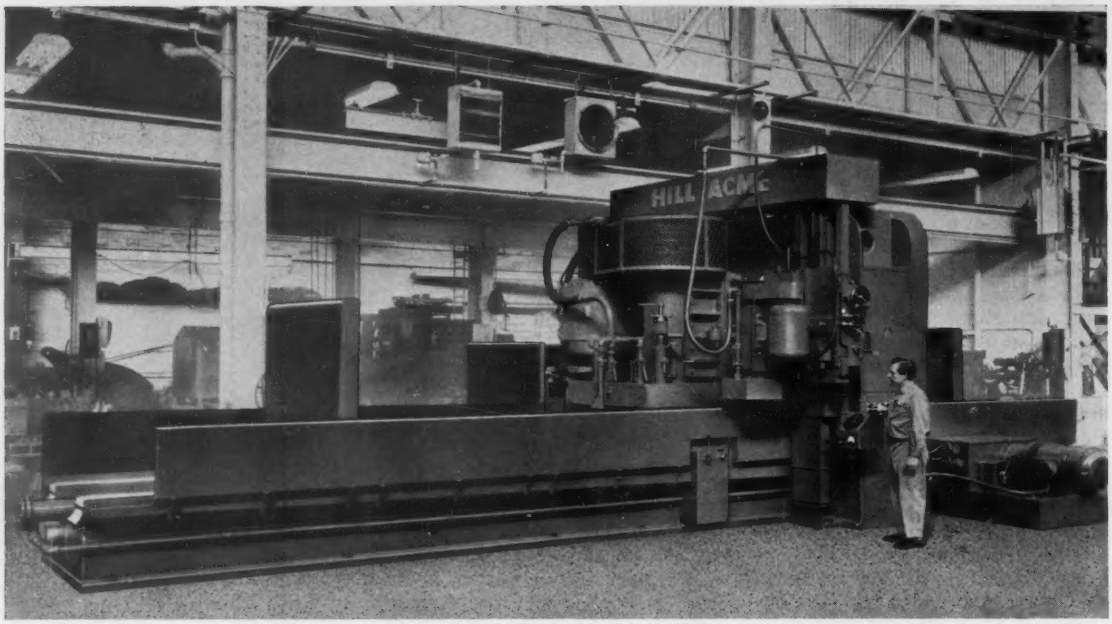

Fig. 1. Huge surface grinder with hydraulically operated table recently built by Hill Acme Co.

## Hill-Acme Giant-Size Surface Grinder

The Hill Acme Co., Cleveland, Ohio, has recently completed a huge, vertical-spindle surface grinder built to take heavy stock-removal cuts on large die-blocks or steel plates. This machine will handle work up to 54 inches wide by 144 inches long. It is designed to eliminate the need for planing operations prior to final grinding by producing ground-finish surfaces on rough-rolled plate or forged die-blocks. All parts of this machine are made extra heavy to withstand the load imposed by its large segment grinding wheel which is 42 inches in diameter and is driven by a 125-H.P. motor.

The final grinding operation to precision tolerances and fine surface finish is accomplished with the large segmental wheel. The grinding-wheel head is traversed hydraulically across the table for two reasons: first, when using the large grinding wheel the entire head is reciprocated on the cross-rail by means of its own hydraulic pump, valves, and cylinder so that the 42-inch wheel will cover the maximum working surface of 54 inches; second, to permit the use of an auxiliary grinding head powered with a 10-H.P. motor. In this case the large head is moved to the back of the machine, thus permitting the auxiliary head to cover the entire width of the table.

The smaller grinding head can be moved manually or hydraulically in a horizontal direction. The auxiliary head is also equipped for manual vertical movement to permit fine feeding or grinding of shoulders or posts with the side of the wheel. This head can be provided with a cup type wheel 12 inches in diameter for precision finishing operations.

The 48- by 144-inch semi-steel table is reciprocated by two opposed, bronze-lined cylinders fitted with steel pistons. The low-pres-

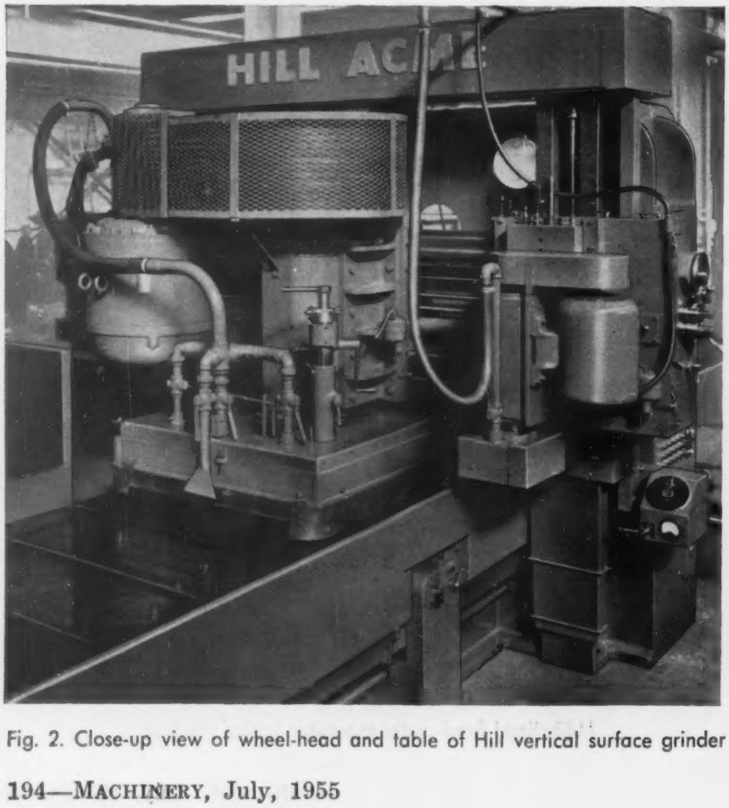

Fig. 2. Close-up view of wheel-head and table of Hill vertical surface grinder

sure hydraulic system is complete with a 20-H.P. pump motor, hydraulic pump, and flow-control valve to regulate the table speed.

The machine is equipped with two motors for the vertical movement of the cross-rail and grinding heads. A 3-H.P. constant-speed motor connected through a gearbox to the elevating screws raises and lowers the rail and the grinding head at the rate of approximately 5 inches per minute. The second motor, a 1-H.P. gear-head motor connected to the elevating screws through the common gearbox and a magnetic clutch is used for the final positioning of the cross-rail and for feeding the large vertical-spindle grinding head to the work. Precision feeding within 0.00025 inch is easily accomplished. A large indicator directly above the feed lever accurately records the depth of cut being taken in thousandths of an inch, and a "per cent of load" meter in the same area indicates the grinding load on the 125-H.P. main-drive motor.

A magnetic chuck consisting of seven rectangular units provides ample power to hold any work. A 2 1/2-inch space is provided between each magnetic-chuck unit to permit taking micrometer measurements of pieces that are being ground and also to permit work-handling hooks to be placed in position for lifting heavy plates. The coolant system consists of a high-volume coolant pump, valves, and large, flare type nozzles. A manually operated wheel-dresser attachment is provided for redressing the large grinding wheel.

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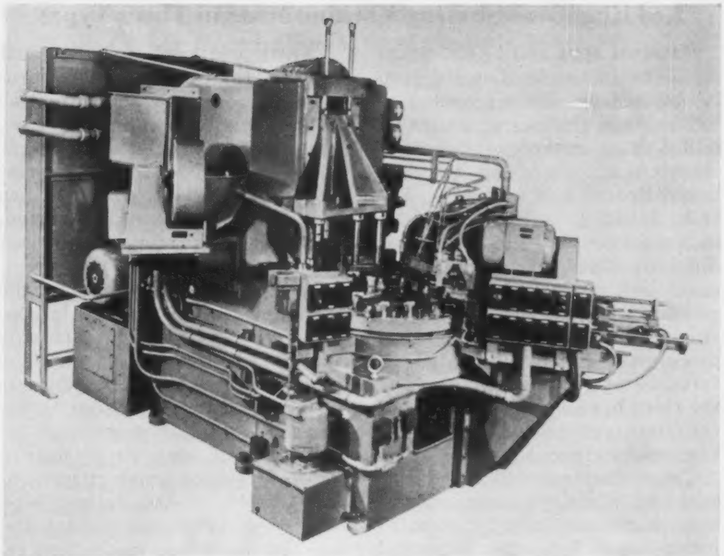

Fig. 1. Vertical hydraulic machine for assembling bushings in connecting-rods and drilling the rods, brought out by the American Broach & Machine Co.

## Machine for Assembling Bushings in Connecting-Rod

A vertical hydraulic machine with automatic cycle designed to assemble bushings in the wrist-pin hole of an automotive connecting-rod, burnish the bushings, center-drill one wall of the wrist-pin bore, and then drill an oil-hole has been brought out by the American Broach & Machine Co., Ann Arbor, Mich. The unit was developed and built around a three-way type machine column, arranged with a six-station index-table. Mounted on the table are six, two-station fixtures, each of which holds two parts. The operator loads and unloads parts as the fixtures index past the loading station. The assembly, burnishing, and two drilling units are arranged around the periphery of the indexing table.

At the assembly station, a hopper feeds the split bushings to a slide which automatically moves them into position for assembly. Following assembly of the bushings in the wrist-pin bore, the parts are indexed to the burnishing station, and then high-speed steel burnishing tools are pushed through the bushings.

The burnishers are returned and the parts indexed to the first drilling station. Here, one wall of the wrist-pin bore is spot-drilled. At the last work station the oil-hole is drilled through the wall and the parts are then indexed to the unloading and loading station. Both drilling stations are equipped with two-station drilling units and separate electric motors.

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Fig. 2. Close-up of tools and work-holding fixtures of machine shown in Fig. 1

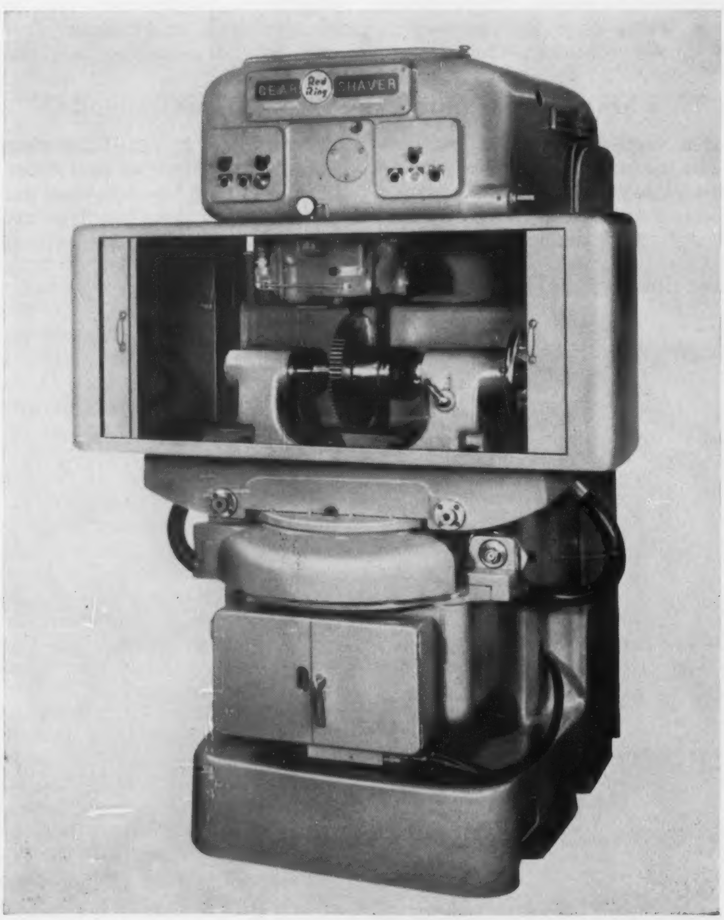
## Red Ring Gear-Shaving Machine Made in Three Types

External spur and helical gears up to 18 inches in diameter can be finished by either diagonal or conventional shaving processes on a Red Ring rotary gear-shaving machine announced by the National Broach & Machine Co., Detroit, Mich. This Model GCU-18-inch machine is available in three different types. The first shaves gears by the high-production diagonal process; the second employs either the diagonal or conventional process and has an automatic differential up-feed mechanism; and the third has all the advantages of the latter type machine and is also adapted for crown-shaving.

These machines will shave both spur and helical gears which have pitch diameters from 2 1/4 to 18 inches and 4 to 16 diametral pitch teeth. The table of the machine has a maximum stroke of 5 inches.

When equipped for diagonal shaving, the work-gear is reciprocated in contact with the cutter at an angle with the cutter axis, while a fixed center distance is maintained between the cutter and work-gear. This work cycle has two strokes—forward and return, and provides for high-speed shaving.

With conventional shaving, the work-gear is reciprocated in contact with the cutter along an axis in line with its center line. The center distance between the work-gear and cutter is reduced an accurately controlled amount at the beginning of each stroke until a depth is reached which gives a finished tooth of the desired size. Then the automatic, differential up- and down-feed mechanism returns the work-gear to the proper backlash position for unloading at the end of the cycle.




Red Ring gear-shaving machine for finishing spur and helical gears by either of two processes.

In the universal type machine, a crowning feature is added in which the work-table is rocked to produce elliptoid teeth that are slightly thinner at the outer edges than at the middle portion.

The cutter is driven by a 3-H.P. motor and the table by a 1/2-H.P. motor. The machine is equipped for coolant. Push-button controls are built into the upper column. The electrical control panel is accessible through a hinged door at the side of the machine. The shaver occupies a floor space about 61 1/2 by 58 inches and is about 88 1/2 inches high.

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## Synthetic Cutting Fluid for Machining Titanium

The results of experimental tests released by the Carbide and Carbon Chemicals Co., Division of Union Carbide and Carbon Corporation, show that tool life in machining titanium metal with a synthetic, water-soluble cutting fluid was increased as much as 300 to 500 per cent as compared to tool life obtained when heavy-duty solubilized oils were used for this material. These results were obtained in comprehensive tests conducted by an independent organization in turning and parting Ti 150 titanium test rings with No. 883 Carboloy carbide-tip tools, using the new synthetic cutting fluid Ucon H-660 in a 1 to 5 ratio dilution with water.

Cutting fluid H-660 forms a clear solution with all proportions of water at room temperature. Its true water solubility permits excellent visibility of the work being cut, formed, or ground. Then, it can be completely removed with a cold-water rinse. The fluid can also be vaporized in heat-treating operations.

This synthetic fluid has been particularly effective in many machining, cutting, forming, and grinding operations on carbon steels, stainless steels, chromium-molybdenum and vanadium steels, and Nitralloy. Non-ferrous metals being worked with this fluid include Inconel, Monel, aluminum and its alloys, phosphor bronze, beryllium copper, silicon brass, Stellite alloy No. 3, and Hastelloy alloys B, C, and D. It has been used with excellent results in grinding boron carbide and other hard, mineral-like materials.

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Direct-current welder made by Vickers Electric Division, Vickers, Inc.

## Vickers Direct-Current Welder

A magnetic amplifier-rectifier type direct-current welder designed to provide full-time automatic arc control under all conditions, is being produced by the Vickers Electric Division, Vickers, Inc., St. Louis, Mo. This welder, called the "Controlarc" is available in 200-, 300- and 400-ampere models. The selected arc characteristics are maintained by automatic, continuous adjustments that meet every change in welding conditions, from arc strike to end of pass. The automatic control assures easy, clean arc strikes; hot starts, and immediate penetration; uniform fusion and steady rate of metal deposit; and prevention of arc "pop outs" and current drop-off.

Automatic control is made possible by the patented Vickers self-saturating magnetic amplifier with voltage-sensing, feed-back control circuits. The magnetic amplifier constantly analyzes welding voltage and automatically adjusts the welding current.

Separate and complete control of both voltage and current makes it possible to obtain any volt-ampere combination within the output range of the particular Controlarc model being used—from minimum voltage at minimum current to maximum voltage at maximum current. Remote voltage-current control equipment is also available.

**Circle Item 108 on postcard, page 235**

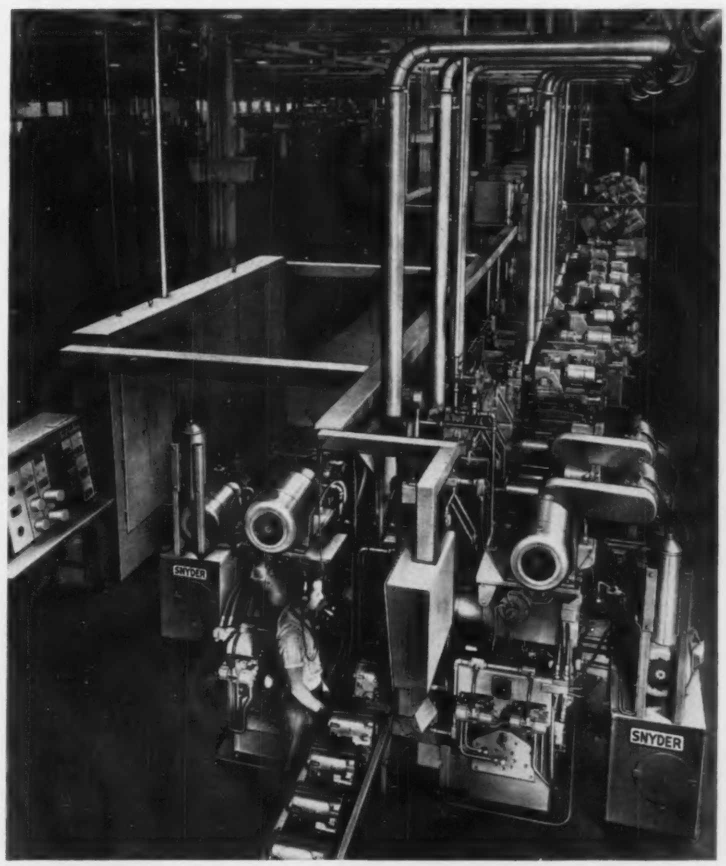
## Snyder Four-Section Transfer Machine for Processing Transmission Cases

An in-line transfer machine featuring sectionalized automation is announced by Snyder Tool & Engineering Co., Detroit, Mich. This machine is 150 feet long, made in four individual sections, and performs 182 milling, drilling, tapping, and boring operations on a cast-iron automotive automatic transmission case. Its machining cycles are arranged to process 100 transmission cases per hour at an operating efficiency of 80 per cent.

Each section of the huge machine, which has a single transfer line, can be individually controlled, loaded, and unloaded. Thus the advantages of sectionalized automation can be utilized either by loading sections from banks of qualified stock or building up banks of qualified stock while any section is shut down for tool changes or maintenance. Operation of all sections can be controlled by one operator if desired. In this case the transfer bar controls the operation of each section.

Individual transfer mechanisms and single control panels are provided for each section. Ingeniously designed automation devices orient the parts to three different positions for processing. At one station, the part is actually removed from the transfer bar line to a fixture where it is tipped at an angle for drilling an otherwise inaccessible hole, and then returned to the line.

Duplex boring spindles, in which individual inserted-tooth milling cutters are mounted on separate concentric spindles, are featured in two stations on the machine. This type of spindle design enables cutters of different diameters to be compactly mounted, yet travel at correct surface speeds. Compound milling slides, in which the cutters feed to depth and then cross feed, are also featured in the




In-line four-section transfer machine built by the Snyder Tool & Engineering Co., for processing automatic transmission cases.

machine. This design avoids cutter drag across the work.

All boring, facing, and milling cutters on the machine are of the inserted-tooth carbide types. Tool control boards show when tools should be changed. A ready stock of sharp tools is mounted on the control boards. Standard Snyder vertical and horizontal self-contained slide units are incorporated in the machine design.

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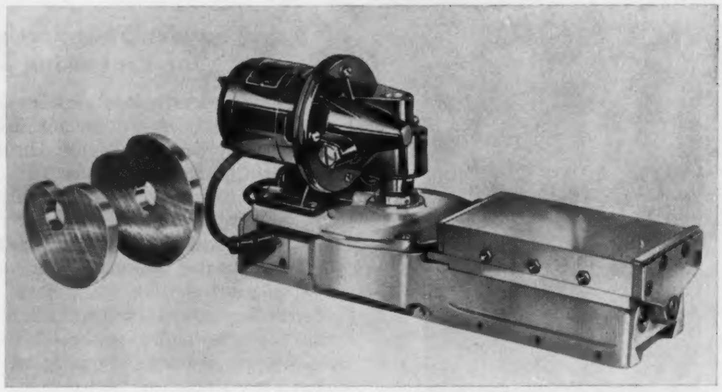


Cam-controlled automatic power feed unit announced by Russell T. Gilman, Inc.

## Two-Way Drilling Unit for Standard Drill Press

A compact, two-way unit designed for economical right-angle drilling on any standard drill press has been brought out by the Michigan Drill Head Co., Detroit, Mich. The unit can be easily mounted on the drill press. It is locked in place either manually or automatically by a cam wedge and utilizes the feeding mechanism of the press. With these units, set-ups can be changed quickly.

Pressure from the vertical unit, while drilling, advances the horizontal unit. Feeding of the cross or right-angle spindle is accomplished by a rack and pinion. All moving parts are lubricated, automatically, by means of a reservoir built into the unit. The unit shown in the illustration is set up for drilling four holes in a gear-shift lever. Additional spindles can be provided for either the vertical or the horizontal drilling positions.

Circle Item 110 on postcard, page 235

## Gilman Cycling Power-Feed Unit

Cam-controlled automatic feed cycles for precision metal-working operations are provided by a new cycling power-feed unit, announced by Russell T. Gilman, Inc., Janesville, Wis. This low-cost product is an addition to the company's line of standard components for special machine tools.

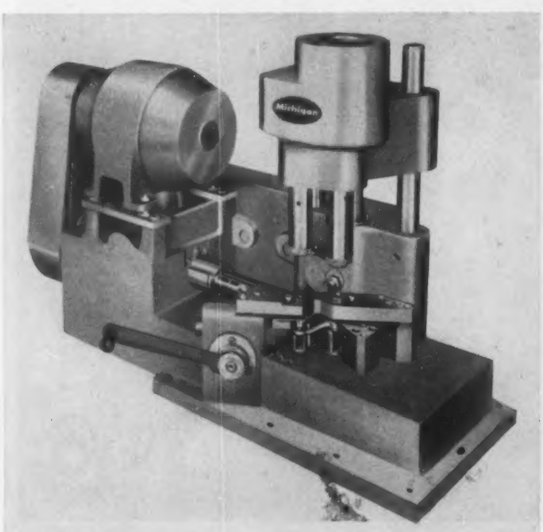
The self-contained mechanical unit consists of a slide assembly, feed mechanism, cam drive motor and housing. Any desired tooling set-up may be mounted on the slide by the user. The equipment is designed for drilling, tapping, boring, reaming, sawing, milling, and broaching small parts.

Cams for controlling the feed cycle can be made by the user or supplied to order by the manufacturer. An infinite variation in feed cycles is possible through the simple medium of changing cams. The unit is compact, measuring only 17 inches long, 6 inches wide and 8 1/8 inches high. It can be mounted in a horizontal or vertical plane, or at any angle. Installation is completed by fastening two socket-head cap-screws and connecting to a 110-volt alternating-current line. The slide assembly has a working surface of 4 by 6 inches and a stroke of 2 inches.

Circle Item 111 on postcard, page 235

## Enco Magnetic-Base Indicator Holder

A magnetic-base dial indicator holder, designated "Tiny-Titan" No. 130, has recently been placed




Compact two-way drilling unit for drill press

Magnetic-base indicator holder made by the Enco Mfg. Co.

on the market by the Enco Mfg. Co., Chicago, Ill. A sure-grip, non-breakable yellow Tenite plastic case 1 1/4 by 1 7/16 by 1 1/2 inches high encloses the magnet which has a pull of 65 pounds. A ball and swivel of brass, with stem of non-magnetic material, isolates the magnet from the indicator. A knurled lock-nut is provided which enables the post to be quickly and firmly secured in the desired position. A knurled set-screw, permits precision adjustment of the gage.

Circle Item 112 on postcard, page 235

## Alpha Production Press

A 100-ton production type press has just been announced by Alpha Press & Machine, Inc., Detroit, Mich. This press is only 7 feet high and occupies a floor space of 75 by 84 inches. It is equipped with a four-speed operating control mechanism which permits a choice of 40, 50, 60 or 80 strokes per minute.

The drive mechanism is housed in the base and pulls the head down, eliminating overhead thrust and assuring accurate alignment by both punch and die. Features include a forced-feed lubricating system, herringbone back-gears and an air-operated clutch. Two hand-operated safety push-button controls and one emergency stop-button are provided to assure safe operation.

Circle Item 113 on postcard, page 235

## Wells Metal-Cutting Band Saw

Development of a heavy-duty hydraulically operated, metal-cutting band saw, designated Model 1200, has been announced by the Wells Mfg. Corporation, Three Rivers, Mich. Design features of this machine include a new electrical system which provides overload and low-voltage protection and 110-volt current at the controls for greater safety. Push-buttons and other controls are located at convenient heights to facilitate operation.

Other distinctive features are: new controls that provide a wide range of uniform feeding pressures for the blade; automatic cutting cycle; special chip-flushing unit; heavy-duty adjustable blade guides; simplified blade tensioning; adjustable depth stops for use in cutting die-blocks; and positive stock stop.

The saw has a capacity for cutting-off round stock 12 3/4 inches in diameter; rectangular shaped bars 12 by 16 inches and 11 by 18 inches. The blade is 13 feet 6 inches long, 1 inch wide and 0.035 inch thick. It can be operated at selective speeds of 60, 115, 200 or 300 feet per minute. The base is 28 by 48 inches and the over-all size 44 by 78 by 60 inches. The top of the bed is 24 1/4 inches above the floor. Shipping weight is approximately 1950 pounds.

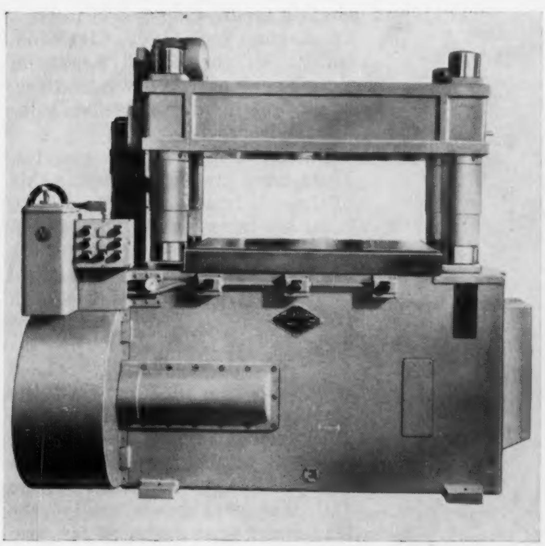
Circle Item 114 on postcard, page 235


Air hoist announced by Keller Tool Division of Gardner-Denver

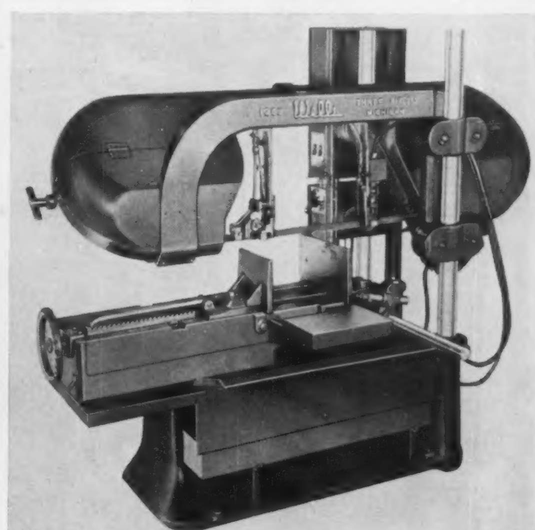
## Keller Air Hoist

Several new air hoists have been announced by the Keller Tool Division of Gardner-Denver, Grand Haven, Mich., making a total of six different Keller hoists now available. Called "High-Rate-Of-Lift," the models have capacities of 500 and 1000 pounds and a lifting rate of 35 feet per minute. The higher capacity link-chain models can handle 1000 or 2000 pounds at a lifting rate of 19 feet per minute. The 1000-pound hoist weighing only 28 pounds, can be handled easily by one man.

There are also two models especially designed for efficient handling of smaller loads. One is a 300-pound capacity unit able to



Production press with push-button controls built by Alpha Press & Machine, Inc.

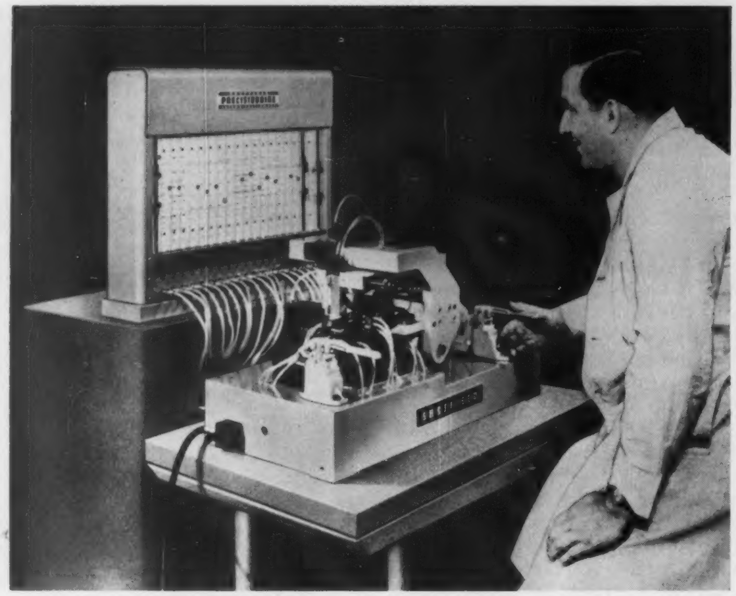


Heavy-duty metal-cutting band saw developed by the Wells Mfg. Corporation.

lift a full capacity load at the rate of 80 feet per minute. The other has a 150-pound capacity and is intended for jobs that are too heavy to lift by hand.

Circle Item 115 on postcard, page 235

## "Precisionaire" Gage for Jet-Engine Turbine Vanes



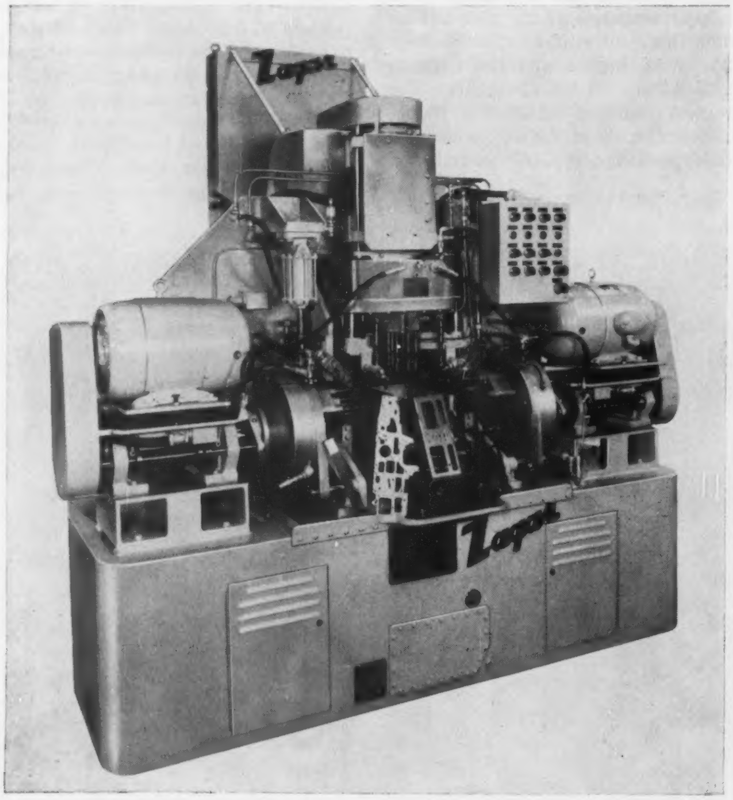
Precisionaire gage for simultaneously checking nineteen dimensions on turbine vane for jet engine

A jet-engine turbine vane can be checked at nineteen points simultaneously with "Precisionaire" gaging equipment manufactured and assembled by the Sheffield Corporation, Dayton, Ohio. The points or elements inspected are: width, location, and depth of tab; side taper of outer buttress form; over-all length; taper of inner buttress form at two places; over-all length of outer buttress; depth of reference-locating surface; and location of seven machined surfaces on outer buttress.

The Sheffield "Plunjet" gaging cartridges used as the size-sensing elements are connected to the nineteen-column Precisionaire unit. Across the face of this unit is a plastic chart, inscribed with minimum and maximum tolerance lines. As long as the floats assume a position between their respective tolerance lines, the part is acceptable. If they do not, the operator knows which dimension or dimensions are faulty and just how much each is over or under the tolerance limit. An inexperienced operator can use the gage with proficiency after a few minutes' instruction.

Circle Item 116 on postcard, page 235

## Zagar Tapping Machine Designed for Versatility



Tapping machine for electric typewriter frames built by Zagar Tool, Inc.

A machine designed to tap the right and left sides as well as the back and front of the frames for electric typewriters has been built by Zagar Tool, Inc., Cleveland, Ohio. The three drill heads on this machine have twenty-three, twenty-one, and twenty-five spindles respectively.

Sixteen No. 6-40 and two No. 10-22 holes are tapped in one side of the side frames. Two No. 1/4-20 holes are tapped and two 1/4-inch holes are counterbored in the top of the frame. Six holes are tapped in the side and top of the back section of the frame and eight holes in the front piece.

A traversing type fixture is used which can be pulled out from the machine to facilitate loading. Mechanical linkage in the air clamping mechanism makes operation possible should the air system fail. The drill heads are of the lead-screw type designed for precise tap control. Production is approximately 120 parts per hour.

Circle Item 117 on postcard, page 235

## Air-Operated Table Feed for Burke Bench Millers

An air-operated, hydraulically-controlled table feed has been developed for the four models of bench type millers made by the U. S. Burke Machine Tool Division, Cincinnati, Ohio. These millers can be equipped with tables either 16 or 20 inches long. An air motor having a stroke of 8 inches can be used, together with an 8-inch stroke hydro-check valve, limit switches, transformers, and solenoid valves.

The air-hydraulic table feed is adaptable to a wide range of milling, sawing, facing, slotting, and similar operations. Exceptional speed, accuracy, and economy of operation are claimed for this equipment. Distance and speed of the rapid traverse approach, the cutting feed and length, and the rapid automatic return movements are easily varied to suit specific job requirements.

**Circle Item 118 on postcard, page 235**

Burke bench type milling machine equipped with air-operated table feed

## Ex-Cell-O Internal Thread Grinder Equipped for Automatic Work Handling

One of the features in the Ex-Cell-O booth at the Machine Tool Show will be an internal thread grinder with automatic work-handling equipment. This Style 39-A machine built by the Ex-Cell-O Corporation, Detroit, Mich., will be equipped to receive work from a conveyor, finish-grind the thread automatically, and eject the completed parts onto an endless belt. The work-pieces consist of ball-race nuts used in steering gears, wherein anti-friction balls circulate between the nut and the screw. The thread form is first cut by an Ex-Cell-O Scru-Broach (also at the Show), and the parts are heat-treated prior to the thread-grinding operation. The point at which the thread begins must be accurately located with respect to a keyslot in the nut.

In operation, a loading arm picks a part out of a chute, pivots downward, thrusts the work into the chuck, and rotates the part until a locating key drops into the keyslot. The chuck then clamps the work in place and the arm retracts. Next the wheelslide comes forward and the work rotates and reciprocates in contact with the wheel.

The grinding wheel is shaped by a motor-driven diamond dresser to suit the gothic-form thread to be ground. Dressing of the grinding wheel is performed as part of the automatic cycle.

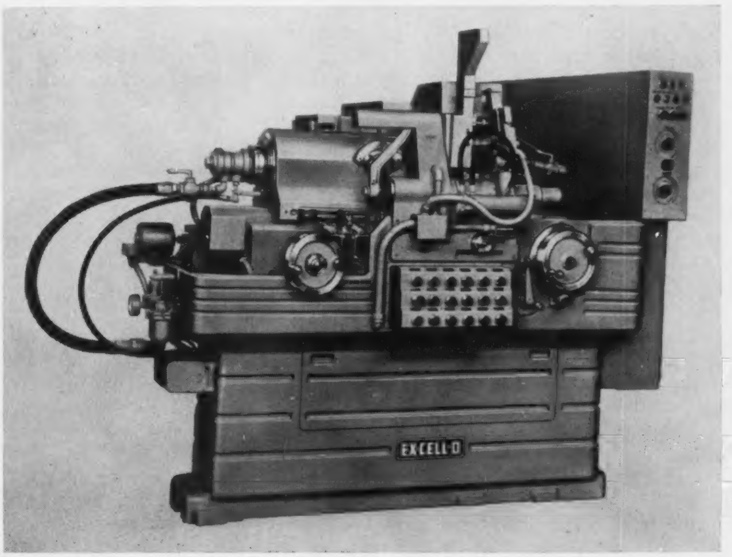
**Circle Item 119 on postcard, page 235**

## Lubriplate for Guide Pins and Bushings

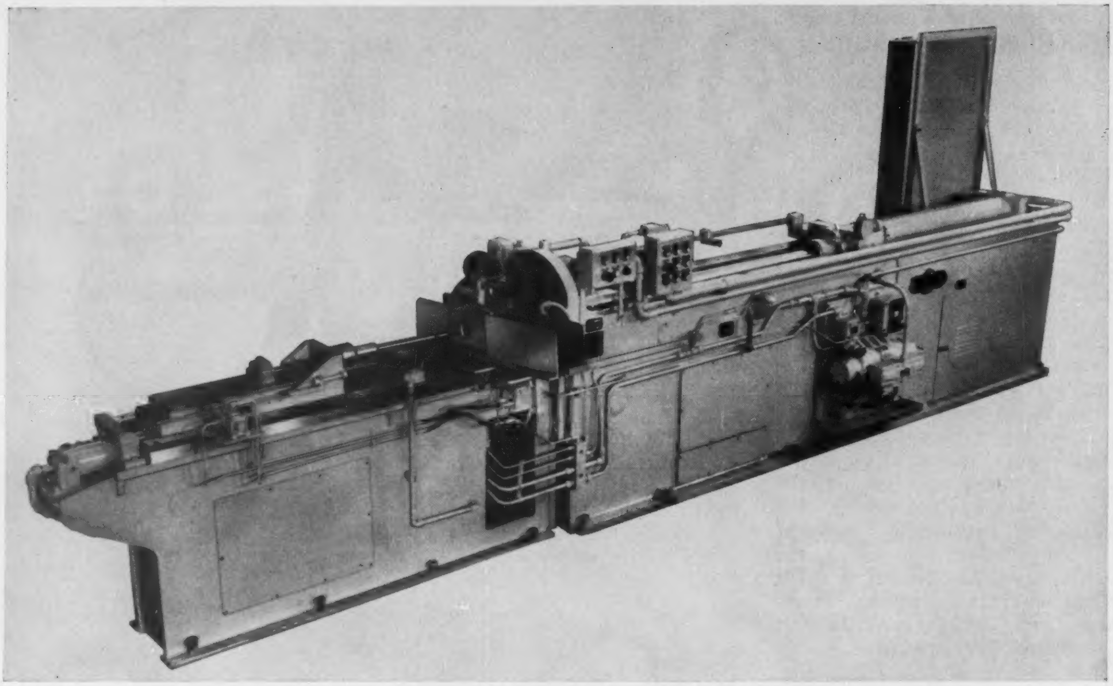
Lubriplate in a tube 2 inches in diameter by 8 inches long which is especially well suited for use in lubricating guide pins and bushings for die-tryout work in the tool-room, is now available from the Producto Machine Co., Bridgeport, Conn.

A microscopic film of lubriplate affords excellent lubrication for operating dies and adequate protection against corrosion during storage of die sets. The tube is easily stored in tool boxes and provides a simple means of applying the compound to guide pins.

**Circle Item 120 on postcard, page 235**




Internal thread grinder equipped for automatic work handling



Machine for automatic broaching of rotors for electric motors built by American Broach & Machine Co.

## Automatic Horizontal Broaching Machine

An automatic horizontal broaching machine with electrical controls, brought out by the American Broach & Machine Co., Ann Arbor, Mich., broaches the inside diameter of laminated rotors for electric motors. Designed to fit in a conveyor line, this machine automatically positions, clamps, broaches, and ejects the rotors one at a time.

A sliding fixture with automatic split vees is used to position and clamp the part. These vees retract individually to accept parts from the conveyor line and eject them after broaching. An automatic broach carrier and clamp mechanism interlocked to the machine cycle carries the broach forward through the part until it connects with the broach pull-head. A hollow clamp nose on the carrier slides the fixture forward, seats it, and then clamps it within the flanged rim of the part. Following the broaching stroke, a drag link in the carrier returns the fixture to alignment with the chute, allowing the part to be ejected. A step cycle then moves the carrier forward to pick up the broach and return it to the starting position for the next stroke.

A universal chute which can be adjusted in size to accommodate several different rotors, feeds the parts to the fixture. Retracting jacks in the chute are used to hold and release the parts one at a time. Operation of the cycle is completely automatic. The machine continues to cycle as long as parts coming in actuate the electrical interlocks.

Circle Item 121 on postcard, page 235

## Onsrud Skin-, Spar-, and Profile-Milling Machine

The Onsrud Machine Works, Inc., Chicago, Ill., has recently built two huge 85-ton A-72C milling machines for the Boeing Aircraft Co. The particular machine shown in Fig. 1 will be used in the Wichita Division of this company in carrying out its B-52 plane-building program. Versatility is an outstanding feature of this machine. It is equipped to do work ordinarily requiring the use of three machines, generally referred to as skin-, spar-, and profile-milling types.

The ability to produce very accurate work when equipped with thin templates, such as may be seen in Fig. 2, is an important feature of the new machine. The use of templates no thicker than 1/8 inch is made possible by employing motor units having electronic tracer controls. The thin templates also have the advantage of requiring a comparatively small storage space.

Milling of aluminum parts to any desired contour is accomplished by the use of either one, two, three, or four cutter-heads as required. The table and beds of the machine are stationary and the gantry type carriage supports cutter-heads which are fed over the work. This arrangement provides for the addition of extra bed lengths whenever needed without necessitating any changes in design.

A 3-H.P. unit drives the carriage longitudinally along the bedways at variably controlled speeds up to 9 feet per minute and at a rapid traversing speed of 18 feet per minute. One invomilling head and two vertical 60-H.P. cutter-heads are used for profile- and skin-milling work. The invomilling head has a two-speed motor which transmits 15-H.P. at a speed of 7200 R.P.M. and 30-H.P. at 14,400 R.P.M. This unit performs profiling operations with a three-

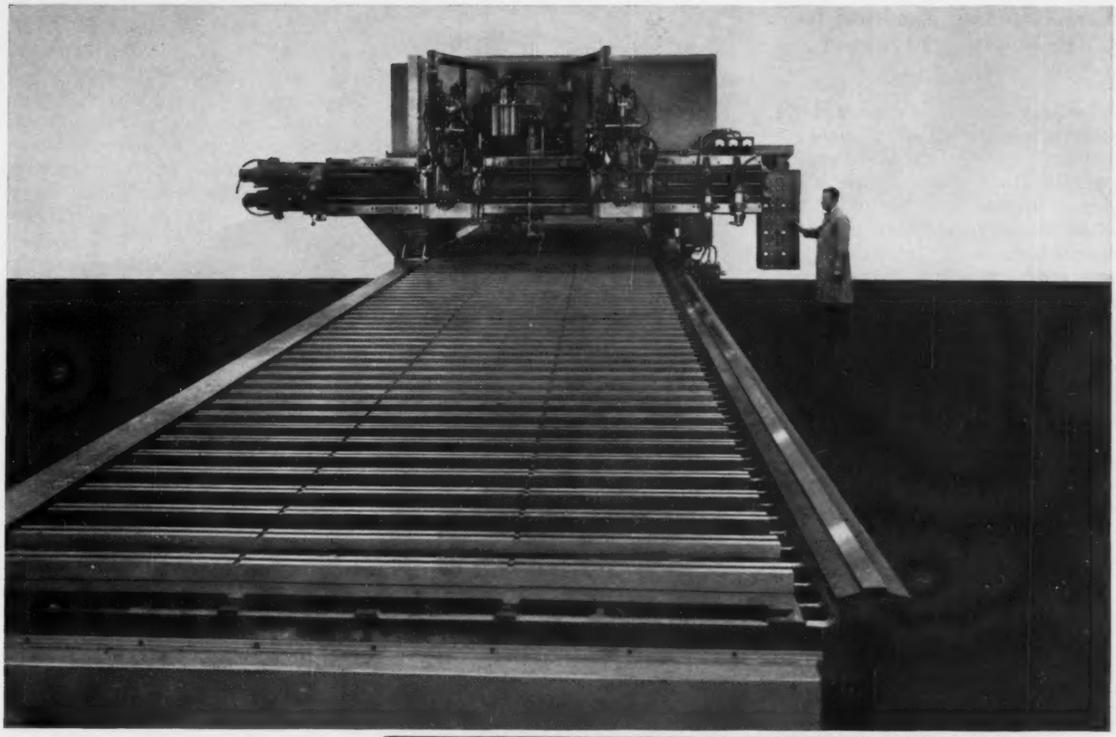


Fig. 1. Huge aircraft skin-, spar-, and profile-milling machine built recently by the Onsrud Machine Works, Inc.

way feed and pneumatic compensator, enabling very fast and accurate cuts to be taken on corners as well as in a straight line.

Each of the two 60-H.P. cutter-heads on the cross-rail is designed for feeding in a vertical plane, transversely across the tables, and also to be tilted at an angle with respect to a constant pivoting center. Transverse motion is controlled by a single dimensional tracer unit mounted on the same cross-rail. A stylus of the same diameter as the cutter is mounted on this unit. The contour of the template is reproduced on the work by the cutter as the stylus follows the profile of the template.

Two templates are used for each head, one to control the vertical movement and one to control the angular movement. The selsyn control arrangement used in obtaining vertical and angular movements makes it possible to employ a bank of seven templates for each head. This gives a total of twenty-eight possible motions for the four heads.

**Circle Item 122 on postcard, page 235**

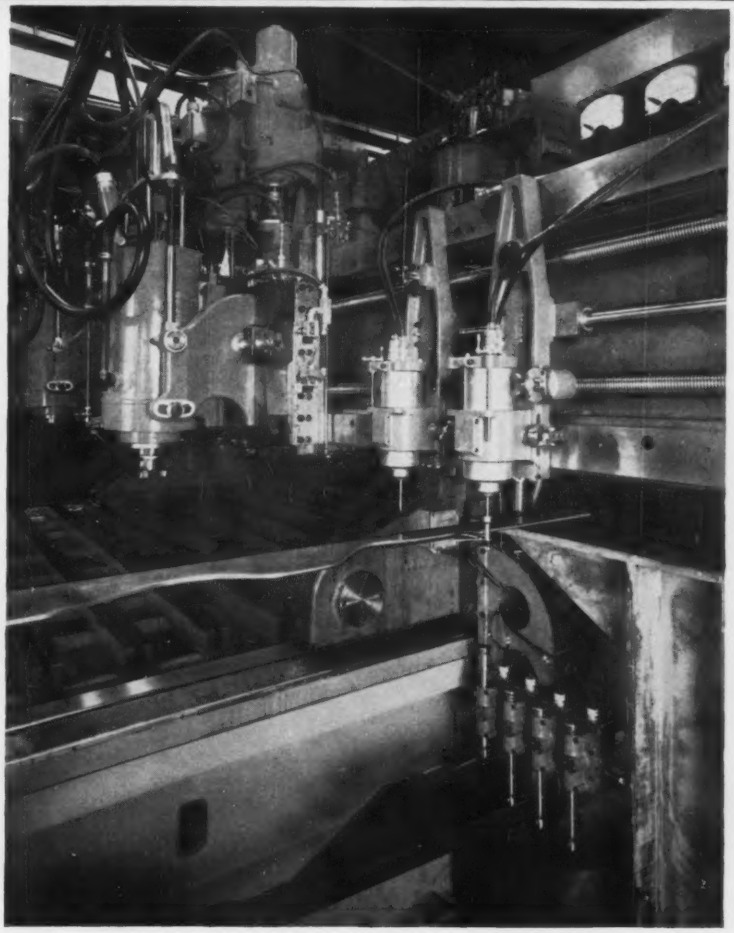


Fig. 2. Close-up of cutter-heads, and templates of machine shown in Fig. 1

## Cross Special Machine for Processing Flywheel Housings

Several unique features have been incorporated in a machine tool built by The Cross Company, Detroit, Mich. The machine is designed to completely machine flywheel housings for both standard and automatic transmissions, except for grinding three faces. Either part may be produced as required. This flexibility for scheduling is made possible because the set-up changes and the proper tools are selected automatically at each station.

As many as 139 operations are performed on 170 pieces per hour. They include 49 drilling, 22 chamfering, 4 reaming, 2 counterboring, 30 inspection and 30 tapping operations.

Because the parts are irregular in shape, special palletized work-holding fixtures are provided. The parts are clamped to the fixtures by hydraulic power wrenches, and pallets are transferred automatically from station to station and returned to the loading station. All standard and special parts of the machine are interchangeable. Features include construction to J.I.C. standards, hardened and ground ways, hydraulic feed and rapid traverse.

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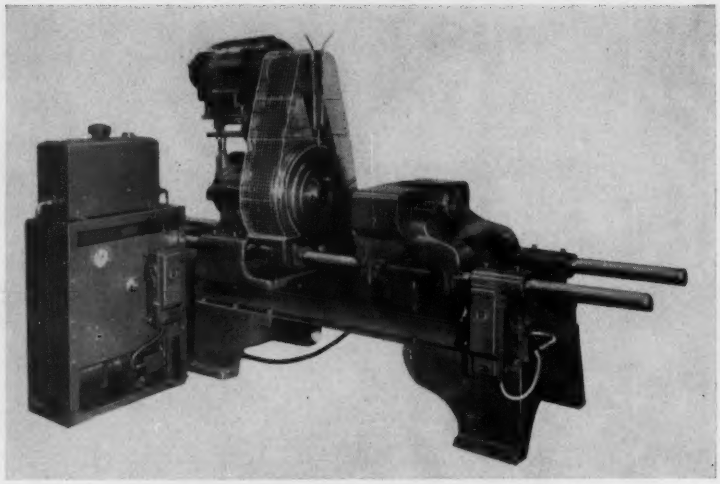


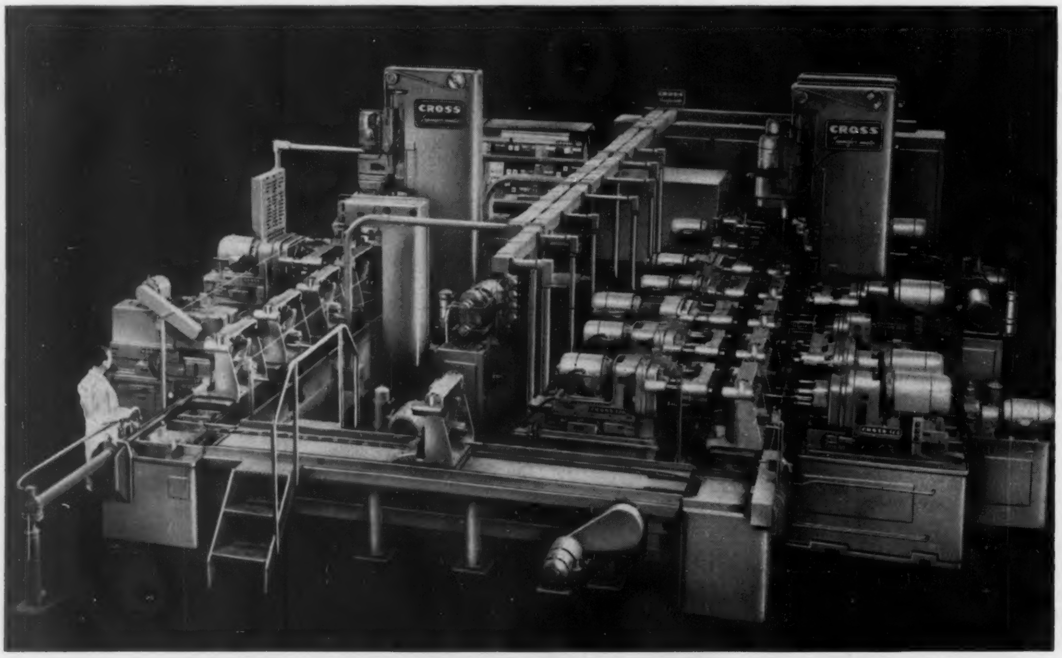
Cold-swaging machine introduced in this country by the Abbey Etna Co.

## Stevens and Bullivant Swaging Machine

A low-cost Stevens and Bullivant swaging machine designed for light swaging and pointing operations on tubes is being introduced in this country by the Abbey Etna Co., Toledo, Ohio. This machine is being added to the latter company's line of heavy-duty tube mills, roll-forming and allied equipment in order to supply the demand for a light, low-cost machine for applications not requiring the extreme precision of the heavier Etna machines.

The Stevens and Bullivant swaging machine is of the four-die, fixed-head, inverted rotary type and is available in four sizes for handling tubes from 1/2 inch to 6 inches in diameter. The four-piece dies are mounted in a fixed head and do not rotate. A distinct advantage of the machine is its low maintenance cost due to the absence of any centrifugal force acting on the hammer block and dies.

An air blast from the rear of



Cross machine for processing flywheel housings for automotive transmissions

the machine is provided to keep the dies clean. The dies can be changed in from one to two minutes. These machines can be supplied with hydraulic power feeders for production jobs. They are adaptable for a wide range of general purpose production work such as converting rounds into hexagonal, square, or other shapes. Hot-swaging work such as pointing high-carbon and alloy-steel tubes and preparing bars and rods for drawing operations can also be performed by the machines.

**Circle Item 124 on postcard, page 235**

## Pneuma-Serve Automatic Screw-Feeding Device

Screws in a large variety of types and sizes up to 1/4 inch in diameter by 1 1/4 inches in length can be rapidly and automatically fed to a power driver with air-operated equipment brought out by Pneuma-Serve Inc., Cleveland, Ohio. This equipment will feed small bolts, as well as screws, from a hopper to any standard make of power screwdriver.

Enough screws for at least four hours' work can be stored in a hopper such as shown to the right in Fig. 2. Screws selected by an elevator at the bottom of the pick-up hopper of this unit are fed to a magazine track which delivers them to a plastic feed-tube. This tube leads to the feeding device attached to the power driver which is applied by the operator as shown in the illustration. After a screw has been driven, compressed air almost instantly feeds another screw to the power driver.

The special feeder head attached to a power driver is shown in the close-up view, Fig. 1. The large plastic tube through which the screws are fed and the smaller tube for the compressed air line that operates the automatic screw feed may also be seen.

**Circle Item 125 on postcard, page 235**

## Improved Gusher Pump

An improved gusher coolant pump equipped with an NEMA standard totally enclosed fan-cooled ball-bearing motor is being brought out by the Ruthman Machinery Co., Cincinnati, Ohio. The motor operates at either 1800 or 3600 R.P.M. and is manufactured in 1 1/2 through 5 H.P. sizes. A one-piece heavy extended shaft is utilized in this pump to eliminate the necessity for metal contacts below the motor.

Ruthman improved gusher pump

**Circle Item 126 on postcard, page 235**

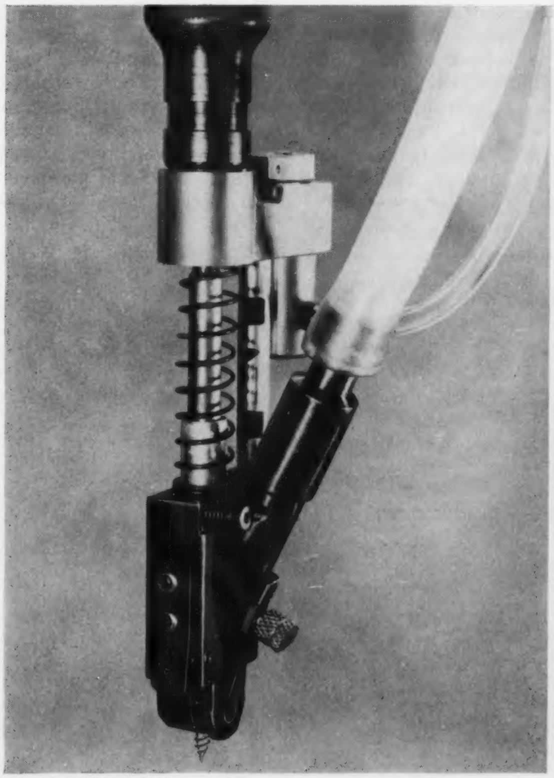


Fig. 1. Pneuma-Serve screw-feeding device attached to power driver

Fig. 2. Automatic screw-feeding equipment made by Pneuma-Serve, Inc.

## "Kon-Toor" Polishing Wheel

A new type of coated abrasive contour wheel designed for automatic polishing of metal products has been developed by the Behr-Manning Division of the Norton Co., Troy, N. Y. This wheel is adapted for polishing complex contours. It is substantially an all-coated abrasive wheel, and is capable not only of being shaped to suit the work, but also of holding that shape as it wears. Designed for use on straight-line and rotary automatic polishing equipment, it is equally adaptable to work employing semi-automatic fixtures where no special attachments or other accessory equipment are required.

The hub is a rugged steel cage whose side flanges are joined by sixteen rods, each supporting an elliptical tube. These tubes hold U-shaped packets of folded, coated abrasive sheets with grain on both sides. Bushings are provided to fit standard drive spindles. Canvas side shields, which reduce wind and noise generated by the relatively open construction, complete the assembly.

The wheels are 17 inches in diameter, and are available in widths ranging from 2 to 7 inches. When greater widths are desired the wheels can be arranged in gangs. Performance is maintained unimpaired throughout the life of the wheel, and replacement wheels are available for ready mounting on the original cage or hub. The abrasive cloth used is Durite (silicon carbide) or Metalite (aluminum oxide) in a grit range of from 120 to 400. Recommended wheel speeds range between 1500 and 2400 R.P.M.

Circle Item 127 on postcard, page 235

## Aircore Grinding Wheel Drums Standardized to Fit Regular Cores

Nu-Matic Grinders, Inc., Cleveland, Ohio, has announced the development of interchangeability in its air-inflated Aircore grinding wheels. The Aircore drums will be standardized to fit standard cores, enabling users to stock a complete line of wheels for a single core. A new model Aircore, designated 525, has also been designed around the Nu-Matic principle, which is said to feature marked improvements in balance, operating speed, and lightness.

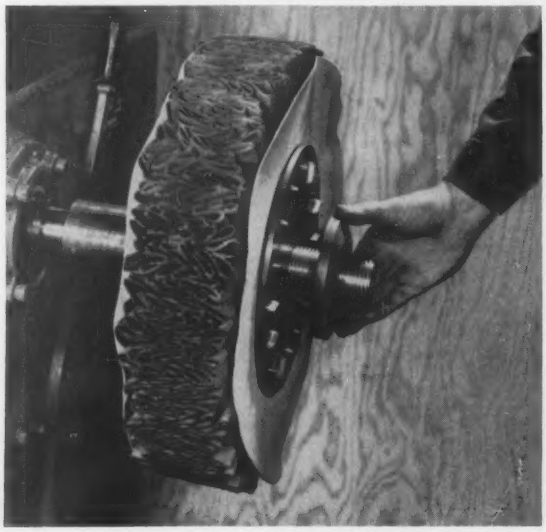
The new operating principle is based on the use of a rubber drum much the same way as a tubeless tire. The "tire" is fitted tightly on a core assembly, which is rotated by the grinder shaft. While the rubber wheel is deflated, the operator fits an abrasive band over the outer surface. The rubber drum is then slightly inflated with air to whatever hardness is required for the operation at hand. Previously, core sizes have varied from model to model, but a user may now order drums of whatever specifications he requires without having to order special cores.

Aircore rubber drum for abrasive band made by Nu-Matic Grinders

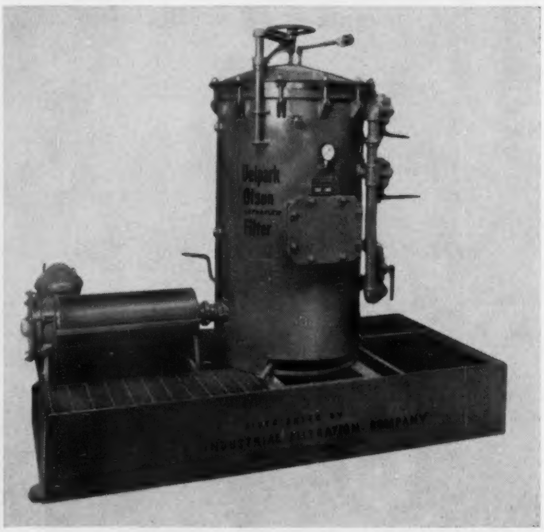
Circle Item 128 on postcard, page 235

## Delpark-Olson Automatic Self-Cleaning Filter

The Industrial Filtration Co., Lebanon, Ind., has announced a Delpark-Olson superflow filter which uses diatomaceous earth with tubular filter elements. This filter is particularly applicable to coolants, cutting oils, test-stand oils, hydraulic oils, industrial cleaning solvents, and chemicals. Screen elements are precoated with diatomaceous earth, forming a filter cake through which the fluid passes. The diatomaceous earth does not affect additives present in most oils and process-



"Kon-Toor" polishing wheel placed on the market by the Behr-Manning Corporation





Delpark-Olson automatic oil and coolant filter brought out by Industrial Filtration Co.

ing fluids. Capacities range up to 175 gallons per minute.

Cleaning is automatic and is accomplished in one to three minutes by forcing the liquid back through the tubular filter.

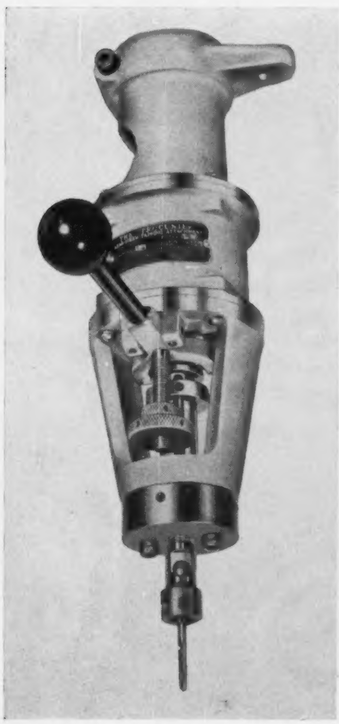
**Circle Item 129 on postcard, page 235**

## Procunier Lead-Screw Tapping Unit

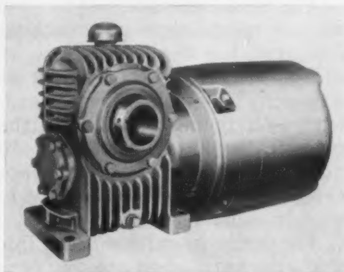
The Procunier Safety Chuck Co., Chicago, Ill., has brought out a lead-screw tapping unit designed to facilitate the production of uniform, precision threads. This unit combines the Procunier cork-faced friction clutch and Tru-Grip tapholder with a lead-screw assembly of entirely new design. It can be manually operated or it can be quickly adapted to air operation when greater speed and convenience are desired. Unlike conventional tapping units, it operates on an entirely new driving principle. By simply depressing the finger tip "trigger arm" (which has a 1/4-inch travel) the tap is fed into the work gently and automatically without applying any pressure on the tap itself. The tap is controlled by the lead-screw.

At the conclusion of the down stroke the clutch is automatically disengaged without over-run. The lead-screw backs out when the trigger-arm action is reversed. The tapping unit will consistently produce uniform threads in any pitch from 20 to 80. Positive stops automatically disengage the clutch at the top and bottom of the stroke without over-run. A stop holds uniform depth to within 0.005 inch. Tapping capacity ranges from 0 to 1/4 inch in soft material and from 0 to 3/16 inch in steel. The entire lead-screw assembly can be replaced in seconds to vary the pitch. The lead-screw travel is 1 3/16 inches.

**Circle Item 130 on postcard, page 235**



Lead-screw tapping unit made by Procunier Safety Chuck Co.



Motorized speed reducer available from Cone-Drive Gears, Division of Michigan Tool Co.

## Motorized Speed Reducers

Double-enveloping worm-gear reducers are now available as motorized units from Cone-Drive Gears, Division of Michigan Tool Co., Detroit, Mich. The line includes both standard extended-shaft and the recently introduced shaft-mounted models with the worm in the over, under, or vertical position. They can be ordered with or without motors.

Motorized Cone-Drive speed reducers offer the many operating advantages of the double-enveloping worm-gear design, including compactness, smoothness, resistance to shock loads, high thermal capacity, and high load-carrying capacity. All motorized models can be wall-, ceiling-, or floor-mounted in any position desired.

The motorized line includes units having center distances of 2, 2 1/2, and 3 inches. Reduction ratios range from 5 to 1 up to 60 to 1. Additional ratios can be obtained through the use of V-belts and sheaves. The units are made in sizes with load capacities ranging from less than 1 H.P. up to 9 H.P.

**Circle Item 131 on postcard, page 235**

(Upper view) Chicago-Latrobe counterbores. (Lower view) Super cobalt drill made by Chicago-Latrobe

## Chicago-Latrobe High-Speed Counterbores and Super Cobalt Drills

Chicago-Latrobe, Chicago, Ill., has brought out a line of high-speed interchangeable counterbore sets designed for use in toolrooms and die and machine shops. Each set is made up of the company's regular interchangeable holders, high-speed cutters, and pilots conveniently placed in a substantial white oak box with hinged cover, as shown in the upper view of the illustration. Sets are available with either straight or taper shank holders having cutters made of high-speed steel in a size range of 3/8 to 2 1/2 inches in diameter. Special sets designed for diemakers have cutters which are 1/32 inch over size.

The super cobalt drill shown in the lower view of the illustration is another recently announced Chicago-Latrobe product. This drill is kept in stock in a complete range of sizes—fractional, letter, and wire gage—with either taper or straight shanks. Because these drills are manufactured of special 8 per cent super cobalt steels, and designed for drilling applications beyond the scope of conventional high-speed drills, they will hold a keen cutting edge longer at higher temperatures.

These drills are said to be especially adapted for drilling materials such as stainless steels, manganese steels, armor plate, certain chromium-nickel alloys, silicon-chromium valve steels, acid-resisting coatings, forgings, chilled cast iron, and titanium alloys. They should be used in a rigid set-up with a constant mechanical feed and moderate speed.

**Circle Item 132 on postcard, page 235**

## Federal Gage for Precision Measuring of Steel Balls

A completely automatic, hopper-fed electronic gage, which measures the outside diameter of precision balls from 1/4 to 17/32 inch in diameter and sorts them into twelve size groups, each within a tolerance limit of plus or minus 0.00001 inch, has been announced by the Federal Products Corporation, Providence, R. I. This gage can be adjusted to sort as many as 24,000 balls in one hour.

Another gage of similar design has been made to measure a wider range of balls at slightly lower speeds. Neither gage will mark or mar the highly polished surface of the balls. Both gages are completely automatic. The operator simply fills the hopper and presses the start button. The gage then measures and sorts the balls according to diameter measurements. This type of gage can be modified to sort rollers for precision roller bearings, checking both diameter and length. It can also be arranged to handle a variety of other small parts.

Circle Item 133 on postcard, page 235

## Ex-Cell-O "Scru-Broach" for Threading Large Nuts

Among the machines which the Ex-Cell-O Corporation, Detroit, Mich., will exhibit for the first time at the coming Machine Tool Show in Chicago is the "Scru-Broach." This is a production machine designed for tough threading operations in large nuts, especially those having fast leads. Such parts as lead-nuts and nuts for circulating ball type screw assemblies can be threaded quickly and accurately on the Scru-Broach. Several of these machines are being used to cut ball-race threads in automotive steering-gear nuts.

The machine is designed to work with a special type of broaching tool that has the appearance of a tap, but the cutting action of a broach. This tool is easily sharpened by grinding the faces of the teeth in the flutes. The teeth are not form-relieved, and therefore can be sharpened repeatedly without changing the size or form.

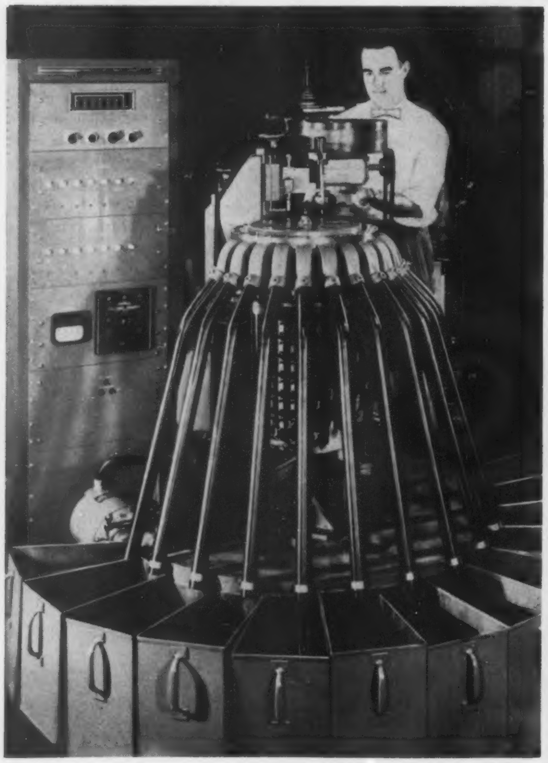
The design permits building this machine with one, two or four work columns, depending on production requirements. A hydraulic system provides pressure for clamping the work, actuating the tailstocks and positioning the fixtures. A motorized pump supplies coolant. The broach is rotated and fed through the work by means of a lead-screw powered by a motor mounted on the rear of the column. The pitch of the lead-screw corresponds with the pitch of the thread being cut to insure lead accuracy and to eliminate the need for gearing.

Circle Item 134 on postcard, page 235

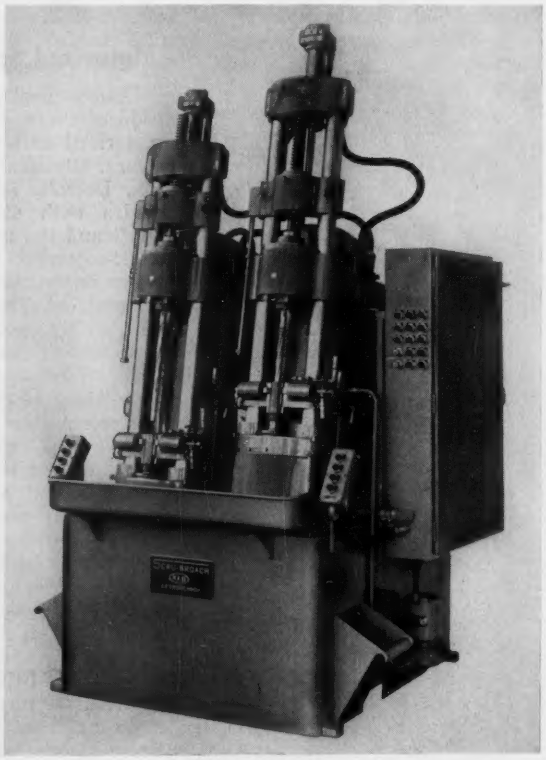
## Tomkins-Johnson Cushion Cylinders for Air and Oil

Flexible "Super Cushions" for air and self-aligning "Master Cushions" for oil, made by the Tomkins-Johnson Co., Jackson, Mich., are said to show practically no wear and present no service problems under long continuous use. They accomplish a complete shut-off of air or oil and assure smooth cushioning with automatic valve action for a fast return stroke.

In these new Spacemaker streamline cushion cylinders, all tie-rods have been eliminated and



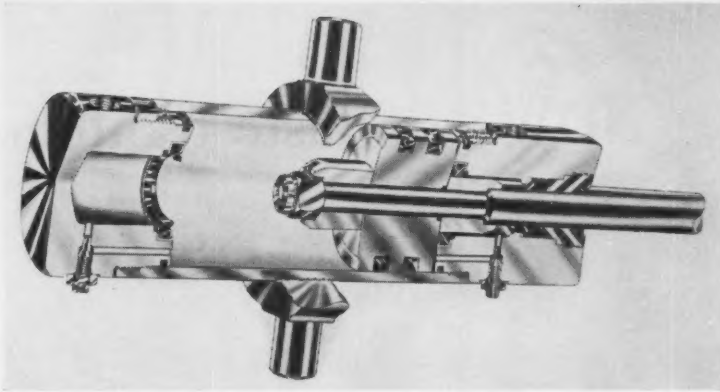
Federal automatic gage for measuring and sorting precision steel balls



"Scru-Broach" for threading large nuts brought out by the Ex-Cell-O Corporation

the cylinder heads have been reduced in size. Other features include hard chromium-plated bodies and piston-rods, solid steel heads and heavy-wall seamless steel bodies. Leakproof construction and an extra high safety factor are other advantages. The cylinders are suitable for air pressures up to 200 pounds per square inch and oil pressures up to 750 pounds per square inch.

**Circle Item 135 on postcard, page 235**



Cut-away view of Tomkins-Johnson streamline cushion cylinder

## Vertical Miller and Jig Borer

The Linochine Products Corporation, Brooklyn, N. Y., is manufacturing a Model MC-1 vertical miller and jig borer with improved features developed for high-production work. This machine is designed to give very fine surface finishes when employed for precision jig boring, drilling, vertical milling, and fly-cutting operations. The tapered spindle bearing, and the hardened and ground tool-steel ways are said to give chatter-free and vibrationless operation even when taking heavy cuts with carbide tools. Twelve spindle speeds ranging from 80 to 3450 R.P.M. are available.

Working dials 6 inches in diameter, and hardened, ground, lapped and stabilized lead-screws are claimed to assure movement and plane surface accuracy within limits of 0.00025 inch. Heat-treated, Mechanite castings are used for all cast parts to insure high tensile strength and rigidity.

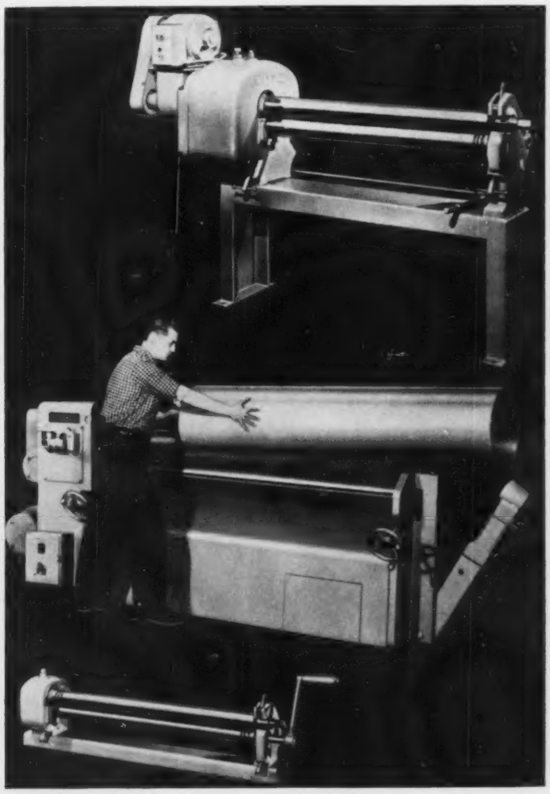
**Circle Item 136 on postcard, page 235**

## Niagara Slip-Roll Forming Machines

A line of power- and hand-operated slip-roll forming machines, featuring pinch type rolls

*(Continued on page 212)*

Vertical milling and jig-boring machine built by the Linochine Products Corporation

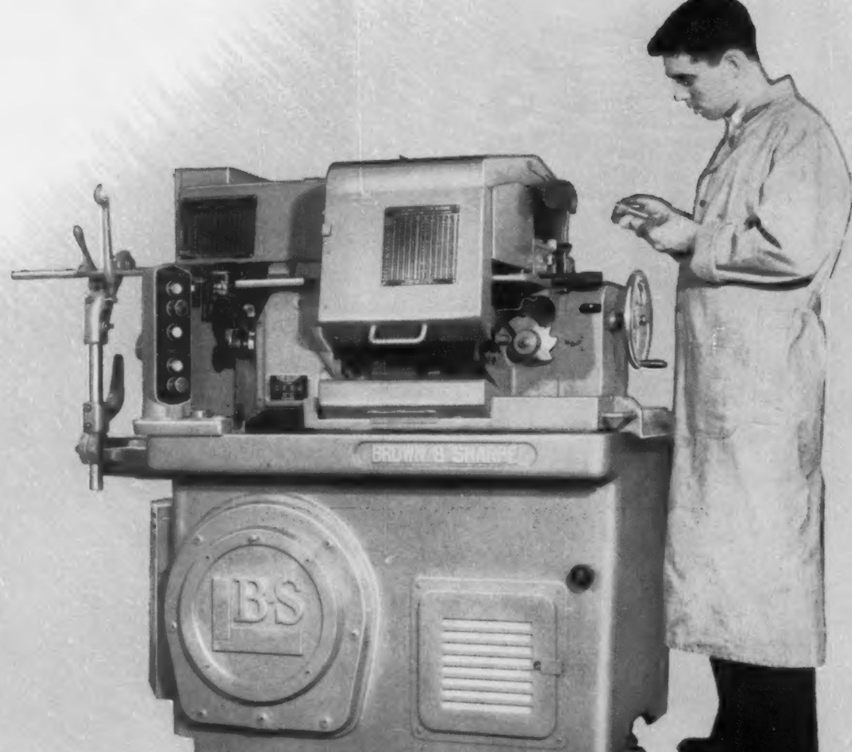


Slip-roll forming machines brought out by the Niagara Machine & Tool Works

NOW! . . . fastest automatic in its range!

. . . as much as 40%

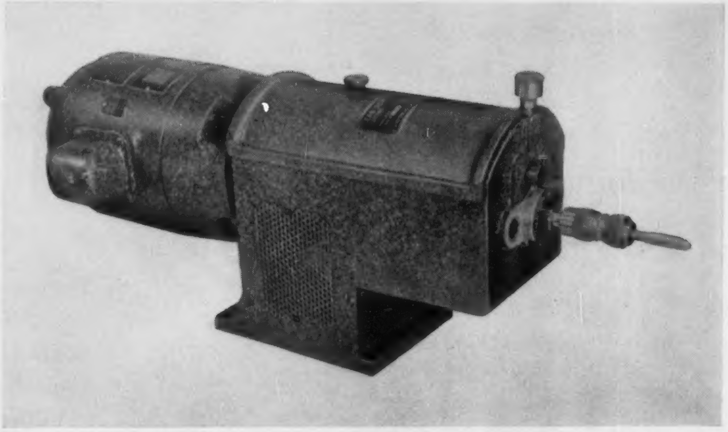
HIGHER



designed to assure production of commercially true cylinders that are virtually free from flat spots, has been brought out by Niagara Machine & Tool Works, Buffalo, N. Y. Two rolls feed the material, while a third roll at the rear deflects the sheet to produce the required curvature. The upper feed roll, around which the sheet is formed, swings open at one end to clear its bearing and thus permits the completed cylinder to be removed quickly and easily.

These slip-roll formers are used in diverse applications to form light and heavy pipe from mild steel sheets up to 1/4 inch thick in lengths up to 120 inches. Stacks, drums, pails, tubs, and other container bodies; large tank segments; and numerous kinds of cylindrical, oval, rectangular, and round products can be formed on these machines. They are built in heavy, medium, and light capacities with 6-, 4-, 3-, 2-, 1 1/2- and 1-inch rolls, and standard units can be fitted with attachments for handling special and quantity production work.

Circle Item 137 on postcard, page 235



Ettco-Emrick electrically operated and controlled lead-screw tapping unit

## Electrically Operated and Controlled Lead-Screw Tapping Unit

Ettco Tool Co., Inc., Brooklyn, N. Y., has brought out an Ettco-Emrick No. 3 lead-screw tapping unit which is self-contained, electrically operated and electrically controlled. This unit is specifically designed for fast, precision single- and multiple-spindle tapping and threading. Forward and reverse electromagnetic clutches, which act instantaneously, eliminate the need for reversing motors and permit operation at extremely high speeds.

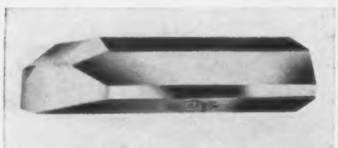
A rheostat control permits the clutch torque to be regulated over a range of from 0 to the equivalent of 2 H.P. This gives the unit the sensitivity required for the smallest taps yet assures sufficient power to drive the larger taps. Since the clutches are energized within themselves, there is no end pressure on either lead-screw or taps. A control knob enables the tap depth to be set to within 1/4-turn anywhere within the maximum stroke of 1 7/8 inches. A self-contained, oil-proof control box provides for easy synchronization of the unit with existing machines.

The hardened and precision-ground lead-screw runs in a bronze split lead-nut. Both lead-screw and nut are interchangeable with ones of different pitch by removing two set-screws. The units may be employed for single-spindle tapping or for multiple-spindle tapping, using Ettco-Emrick fixed or adjustable spindle heads and work-holding fixtures.

Circle Item 138 on postcard, page 235

## Alloy for Holding Diamonds in Dressing Grinding Wheels

Grinding-wheel truing diamond set in new alloy developed by the American Coldset Corporation,



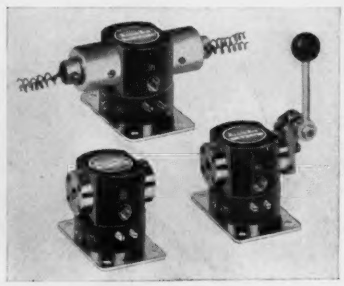
Paterson, N. J. This new diamond-holding alloy named "m-28," combined with a new exclusive setting process is said to guard against diamond loss even under the most difficult operating conditions. This Coldset tool has been found valuable by form-tool users engaged in jet bucket-blade grinding operations.

Circle Item 139 on postcard, page 235

## Allen Air-Control Valves

Air-control valves announced by the A. K. Allen Co., Brooklyn, N. Y. These valves, tested through millions of cycles as an integral part of "AllenAir" cylinders, are now offered as a separate line. Twenty-four different models are available as four-way valves with 1/4-, 3/8- or 1/2-inch ports for operation at pressures ranging from 5 to 150 pounds per square inch. The key models are of the double-solenoid, air-bleed, air-pilot and hand valve types. The double-solenoid valves, available for either 8 volts or 110 volts, as well as the air-bleed models, are of the momentary-contact type. The hand- and air-operated pilot valves are offered either for double actuation or spring return. All valves feature two built-in speed controls, and all friction surfaces are hardened and permanently coated with a baked-on lubricant.

Circle Item 140 on postcard, page 235



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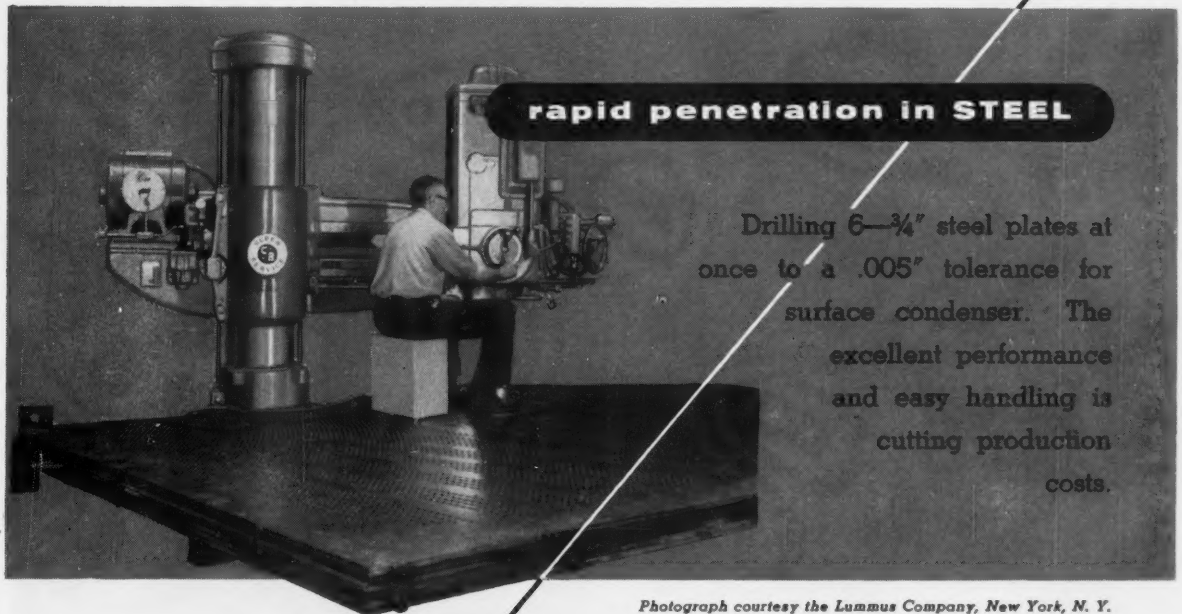
**at THE LUMMUS COMPANY**

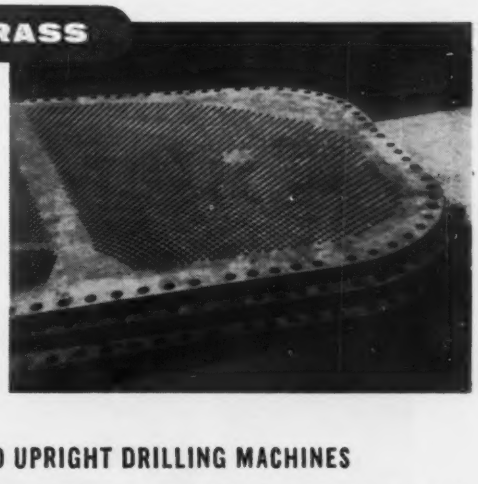
On jobs like these the ease of control, the accuracy and the outstanding speed of penetration of Cincinnati Bickford Radial Drills pay big dividends.



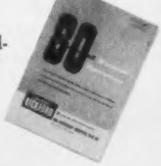

*Photograph courtesy the Lummus Company, New York, N. Y.*

**rapid penetration in BRASS**

Drilling 4 brass tube sheets, 1½" thick, simultaneously to a .002" tolerance, a special spiral brass drill penetrates at the rate of 10" per minute.



Of interest to every user of Drilling Machines—Write for your copy of 80-year Anniversary Booklet.

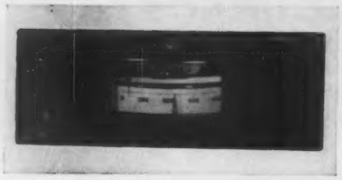


**CINCINNATI BICKFORD**

RADIAL AND UPRIGHT DRILLING MACHINES

**THE CINCINNATI BICKFORD TOOL CO.**

**Cincinnati 9, Ohio, U.S.A.**



## Wheelco Panelmount Capacitrols

A Wheelco millivoltmeter type "Multronic Capacitrol" that incorporates dual electronic control circuits which operate in harmony, but independent of each other, to control a variable process at two different points. Typical applications include the control of two separate fuel systems or furnaces and applications making use of "on-off" controls in addition to the automatic shutting off of fuel lines. Compensated meter movement reduces instrument time lag to a minimum and gives fast control response. Any needed adjustment or setting can easily be made from the front of the instrument. Product of the Barber-Colman Co., Wheelco Instruments Division, Rockford, Ill.

Circle Item 141 on postcard, page 235

## "Steeple" Type Worm-Gear Reducer

"Steeple" type worm-gear reducer for long, unsupported vertical output-shaft extensions, brought out by the Philadelphia Gear Works, Philadelphia, Pa. This reducer has been successfully used in a wide variety of applications. The "Steeple Feature" member can now be mounted on existing standard types of Philadelphia vertical worm-gear reducers without making major modifications in the basic gear unit. The wide bearing span insures extreme rigidity for the

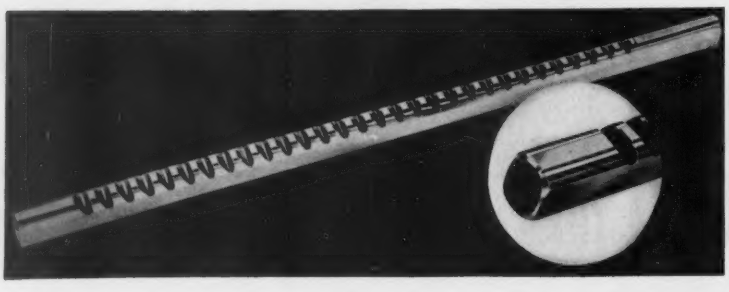
extended shaft, while the "dry-well" construction eliminates the need for a stuffing-box on the vertical shaft. To insure positive lubrication of the upper bearing on the vertical shaft, an automatic reversing oil-pump and a filter are embodied within the housing of the unit.

Circle Item 142 on postcard, page 235

## Push Type Keyway Broach

Production type high-speed steel push-broach from line of keyway broaches announced by the du Mont Corporation, Greenfield, Mass. This broach is available in 1/8, 3/16 and 1/4 inch keyway widths, and in body diameter sizes increasing in steps of 1/16 inch from 1/2 inch to 1 inch. The broaches can be used with hydraulic or hand-operated arbor presses. The back of the broach is ground to fit the radius of the bore in which it will cut so that the body of the broach supports itself in the hole and thus requires no guide or bushing.

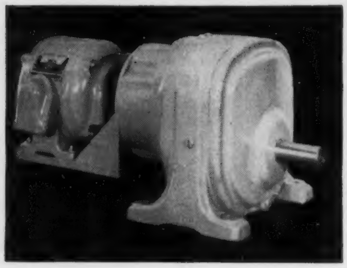
Circle Item 143 on postcard, page 235



## Hydraulic Booster for Steering Mechanism

A low-cost oil-hydraulic power-steering booster designed specifically for materials-handling vehicles in the 4000- to 10,000-pound axle-loading class is now available from Vickers Incorporated, Detroit, Mich. This S22 booster is also intended for use on tractors and other farm machinery having power ratings of 40 H.P. and up, as well as for buses in the 4000- to 5000-pound axle-loading class. Installation of the booster usually requires little or no change in the vehicle steering linkage. The regular assembly tie-rods are eliminated and replaced with end caps which are screwed on and secured with removable tack-welded clips.

Circle Item 144 on postcard, page 235



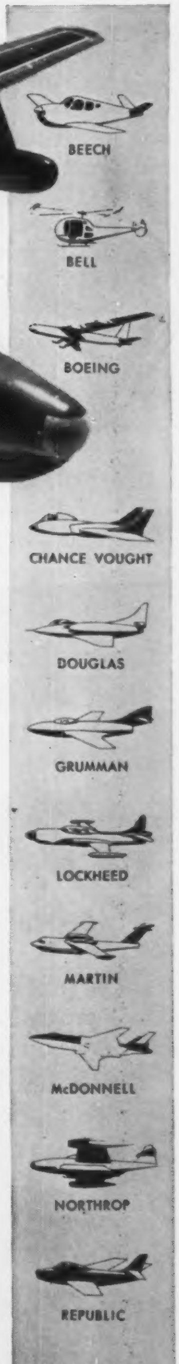
## Sterling "Slo-Speed" Separate Motor Reducer

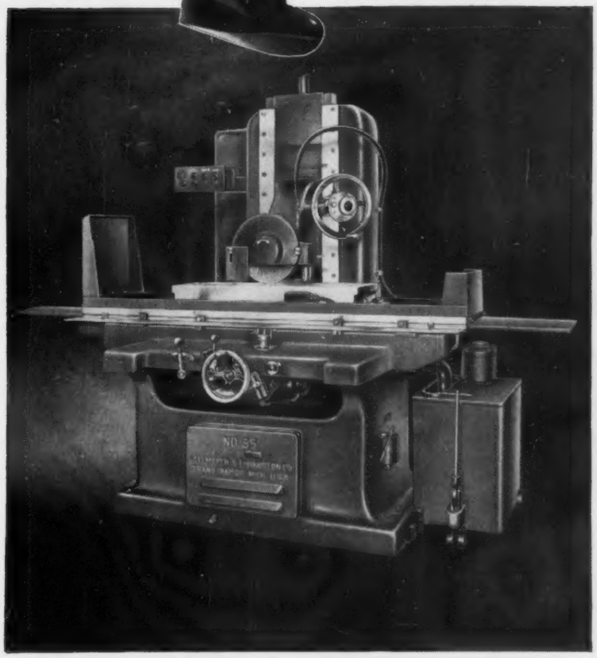
"Slo-Speed" gear-motor offered for separate motor mounting by the Sterling Electric Motors, Inc., Los Angeles, Calif. This unit is designed to meet established machine or equipment standards for such motor-reducer combinations. It provides the required versatility for economically adjusting either horsepower or speeds to meet changing production needs. Can be mounted on floor, wall, or ceiling, with the shaft horizontal or vertical without modification. Separate motor reducers can be supplied with any foot-mounted motors, including drip-proof, totally enclosed, fan-cooled, explosion-proof, wound rotor or direct-current types.

Circle Item 145 on postcard, page 235

FOUND WHERE WORLD FAMOUS AIRCRAFT ARE "BORN"

# GRAND RAPIDS GRINDERS

Just take a look in their toolrooms! Every one of these famous aircraft manufacturers uses Grand Rapids Grinders . . . depends on them for the uncompromising precision on which records and reputations are made.

Grand Rapids Grinders are engineered and built for unusual long life of precision grinding. Our Model 55 shown here, for instance, features column and base of massive, one-piece casting for vibrationless rigidity and permanent alignment. Both longitudinal table travel and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. Table speed is variable up to 125 fpm . . . faster than any other of this type and size.

*That's* why so many tool room men insist on Grand Rapids Grinders.

GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER
This precision tool room type machine has table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.


*Just a note on your letterhead will bring you full details.*

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**DIAL INDICATORS AND GAGES**
Including the complete new line of High Precision — Low Friction Dial Indicators

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Production-proved for maximum cutting performance and economy

**PRECISION GROUND DIE AND FLAT STOCK**
In a complete selection of 4 types, 295 sizes — air, oil, oil or water and water hardening.

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For more information on products advertised, use Inquiry Card, page 235

## AMERICAN STANDARD KNURLING—1

This standard covers knurling tools with standardized diametral pitches. It includes formulas and data for determining the correct dimensions of the knurl and the stock for the production of straight, diagonal, and diamond knurling on cylindrical surfaces having teeth of uniform pitch, parallel to the axis of the cylinder or at a helix angle not exceeding 45 degrees with the axis of the work. The knurling is produced by the displacement of the material on the surface when rotated under pressure against a knurling tool.

These tools and recommendations are equally applicable to general-purpose and precision knurling. In brief, the advantage of this method is the provision by which good tracking (the ability of teeth to mesh as the tool penetrates the work blank in successive revolutions) is obtained. The tools for this work are designed on the basis of diametral pitch instead of TPI (teeth per inch) when used with recommended work blank diameters that are multiples of 1/64 or 1/32 inch, depending upon the pitch selected. This should improve the uniformity and appearance of knurling, eliminate the costly trial and error methods, and reduce the failure of knurling tools and the production of defective work, as well as decrease the number of tools required for this class of work.

### Definitions

Tools may be (A) cylindrical type or (B) flat type.

(A) The cylindrical type knurling tool comprises a holder and one or more knurls. The knurl has a centrally located mounting hole and is provided with straight or diagonal teeth on its periphery, as illustrated in Fig. 4.* The knurl is used to reproduce, by rolling on the work blank, the pattern on the periphery of the knurl as the blank and knurl rotate. The preferred sizes for such knurls are given in Table 3.*

(B) The flat type of tool is a knurling die, commonly used in reciprocating types of rolling machines, as illustrated in Figs. 6, 7, 8, and 9.* Dies may be made with either single or duplex faces having straight or diagonal teeth. No preferred sizes are established for flat dies.

(C) The term "diametral pitch" applies to the quotient of the total number of teeth in the circumference of the work divided by the basic blank diameter—in the case of the tool it would be the circumference divided by the nominal diameter. In this standard, the diametral pitch and number of teeth are always determined by the measurement of the diameter of the pitch circle in a transverse plane, which is perpendicular to the axis of rotation for diagonal as well as straight types of knurls and knurling.

(D) The term "knurl" refers to a tool with teeth on its periphery used to produce an imprint of the teeth on the cylindrical surface of the work.

(E) The term "knurling" designates the process and the knurled portion of the work.

(F) The term "work" applies to the finished product.

(G) The term "work blank" applies to the part prior to knurling.

*To be published in coming number of MACHINERY.

### Knurling Formulas

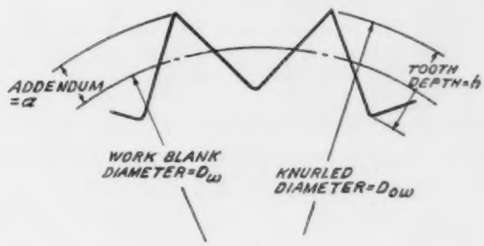


Fig. 1

$P$ = diametral pitch $= \dfrac{N_w}{D_w}$

$D_w$ = work blank diameter $= \dfrac{N_w}{P}$

$N_w$ = number of teeth on work $= P \times D_w$

$h$ = tooth depth

$a$ = addendum of tooth on work $= \dfrac{D_{ow} - D_w}{2}$

$D_{ow}$ = knurled diameter $= D_w + 2a$

Extracted from ASA B5.30-1953 with permission of publisher, American Society of Mechanical Engineers

# MACHINERY'S DATA SHEET

## AMERICAN STANDARD KNURLING—2

### Recommended Tolerances on Knurled Outside Diameters

Three classes of tolerances are included in Table 1.* These classes and recommended applications are as follows:

Class I. Tolerances in this classification may be applied to straight, diagonal, and raised diamond knurling where the knurled outside diameter of the work need not be held to close dimensional tolerances. Such applications include knurling for decorative effect, grip on thumb-screws, and inserts for moldings and castings.

Class II. Tolerances in this classification may be applied to straight knurling only and are recommended for applications requiring closer dimensional control of the knurled outside diameter than provided for by Class I tolerances.

Class III. Tolerances in this classification may be applied to straight knurling only and are recommended for applications requiring closest possible dimensional control of the knurled outside diameter. Such applications include knurling for close fits.

Note: The width of the knurling should not exceed the diameter of the blank, and knurling wider than the knurling tool cannot be produced unless the knurl starts at the end of the work.

### Diagonal and Diamond Knurling with Straight-Tooth Knurling Tools

Diagonal knurling on work blank may be accomplished by setting the axis of the knurling tool at an angle to the work axis.

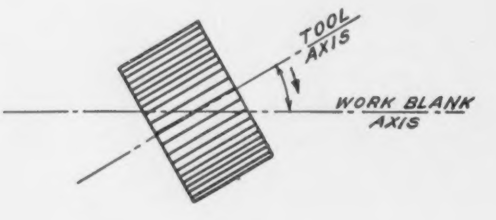


Fig. 2

$\psi$ = angle between tool axis and work axis;

$P$ = diametral pitch on tool;

$P\psi$ = diametral pitch produced on work blank (as measured in the transverse plane) by setting tool axis at an angle $\psi$ with respect to work blank axis;

$D_w$ = diameter of work blank;

$N_w$ = number of teeth produced on work blank (as measured in the transverse plane).

Then

$$P\psi = P \cos \psi$$

and

$$N_w = D_w P \cos \psi$$

For example, if 30 degrees diagonal knurling were to be produced on 1-inch stock with a 160$P$ straight knurl:

$$N_w = D_w P \cos \psi = 1.000 \times 160 \times 0.86603 = 138.56$$

Good tracking is theoretically possible by changing the helix angle as follows:

$$\psi = \cos^{-1}\left(\frac{N_w}{D_w P}\right) = \cos^{-1}\left(\frac{138}{1 \times 160}\right) =$$

$$\cos^{-1}(0.8625) = 30\tfrac{1}{2} \text{ degrees, approximately}$$

Whenever it is more practical to machine the stock, good tracking can be obtained by reducing the work blank diameter as follows:

$$D_w = \frac{N_w}{P \cos \psi} = \frac{136}{160 \times 0.866} = 0.996 \text{ inch}$$

Theoretical work blank diameters on which standard pitch knurls may be expected to track have been listed in Table 2* for the four standard diametral pitch knurling tools and for helix angles of 25, 30, 35, 40, and 45 degrees.

Note: Diamond knurling can be produced by the use of two straight knurls with their axes approximately at right angles to each other in accordance with above formulas.

In using straight knurls to produce diagonal and diamond knurling the transverse diametral pitch and number of teeth on the work will not be the same as that of the tool.

*To be published in coming number of MACHINERY.

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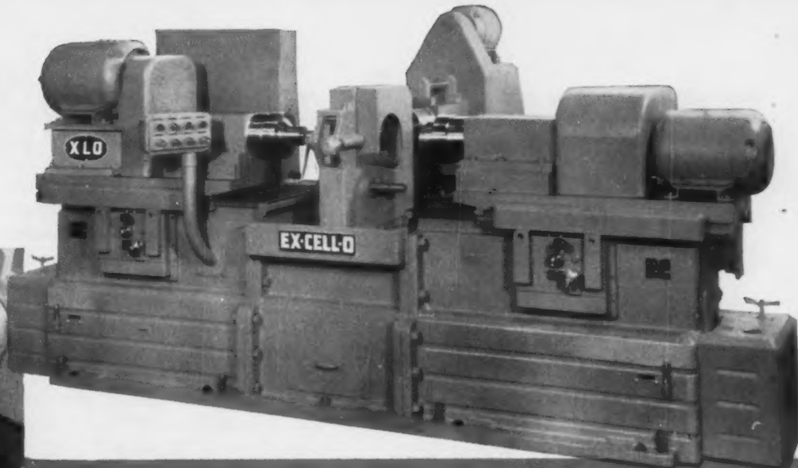
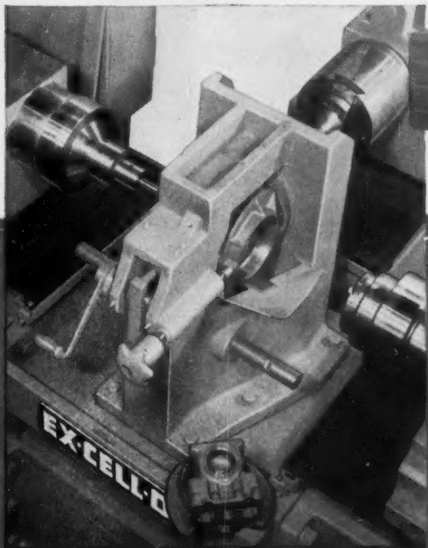
**Ex-Cell-O 3-Way Precision Boring Machine. Standard way units—tooled to suit the work.**

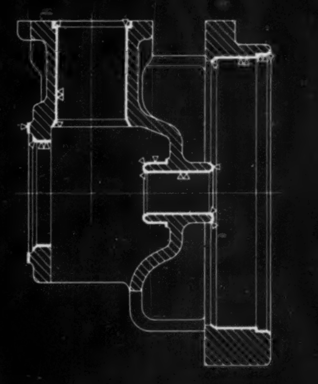
**Note the simplicity of this tooling.**




# Cut Costs-Combine Operations

## . . . INSURE YOUR PROFITS in Today's Competitive Market



Heavy lines show the machined surfaces. Small single triangles indicate single operations; double triangles indicate rough-and-finish operations.

Once a part is properly located and clamped, it's good practice to do as much machining on it as possible before it's moved! Related dimensions are held closer, handling time minimized and production increased.

This Ex-Cell-O 3-Way Precision Boring Machine performs 5 roughing and 18 finishing operations on a cast-iron crankcase used in the refrigeration industry. Tolerances are extremely close on the crankshaft and cylinder bores. Net production for the roughing operation is 33 parts per hour; for finishing, 36 parts per hour.

Ask your local Ex-Cell-O representative about all the other advantages of Ex-Cell-O Way Machines—or write today for Bulletin.

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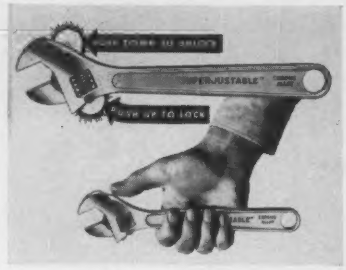
BOOTH 1319

54-30

**EX-CELL-O CORPORATION**

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



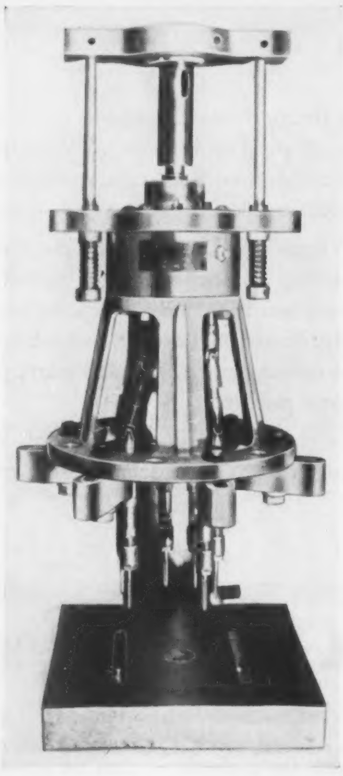
## Williams Self-Locking Adjustable Wrench

Self-locking adjustable wrench announced by J. H. Williams & Co., Buffalo, N. Y. This wrench can be quickly adjusted and positively locked or unlocked by a flick of the thumb or finger. It is drop-forged from selected alloy steel in 8-, 10- and 12-inch sizes, ranging in capacity from 0 to 1 5/6 inches.

Circle Item 146 on postcard, page 235

## Adjustable Multiple-Spindle Drilling Head

Universal-joint adjustable tapping and drilling head announced by Errington Mechanical Laboratory, Inc., Staten Island, N. Y.

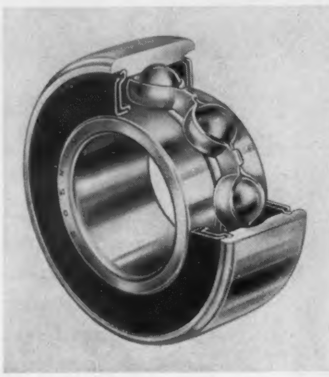


Less than one-half minute is required to change this head from drilling to tapping, or tapping to drilling. The head can be adjusted for drilling or tapping holes laid out to any pattern, is available with four or six spindles and has a positive clutch drive and reverse mechanism. Available in two sizes: No. 0 for taps up to the 1/4-inch size for holes with minimum distance between centers of 11/16 inch and hole-group pattern of 5 1/4 inches; and No. 1 for tap sizes from 7/32 to 1/2 inch with minimum distance between centers of 1 1/2 inches and maximum hole-group pattern of 8 inches.

Circle Item 147 on postcard, page 235

## Fafnir Wide Type Mechani-Seal Ball Bearings

New W-KLL series wide type Mechani-Seal ball bearings now being manufactured by the Fafnir Bearing Co., New Britain, Conn. This bearing is made in standard bore and outside diameter sizes. Its distinguishing feature is the

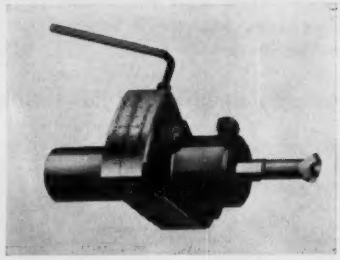


width, which is the same as that of corresponding size double-row bearings. It is made in seven sizes having the same dimensions and load capacities as Fafnir wide type Plya-Seal ball bearings and is designed especially for applications where frictionless sealing and large grease capacity are important.

Circle Item 148 on postcard, page 235

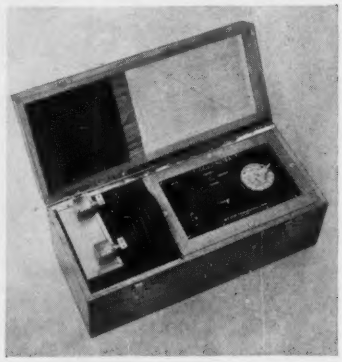
## Bokum Tool-Holder

Holder brought out by the Bokum Tool Co., Detroit, Mich., for use with its boring tools on screw machines or turret lathes. This holder was developed to permit more accurate and faster boring



of holes. While the holder is engaged in boring, other tools are free to carry on different operations—thus increasing production and reducing set-up costs. The heat-treated, alloy-steel holders are adjustable to boring positions of vernier accuracy. Calibrated scales on top of each holder facilitate quick and accurate setting.

Circle Item 149 on postcard, page 235

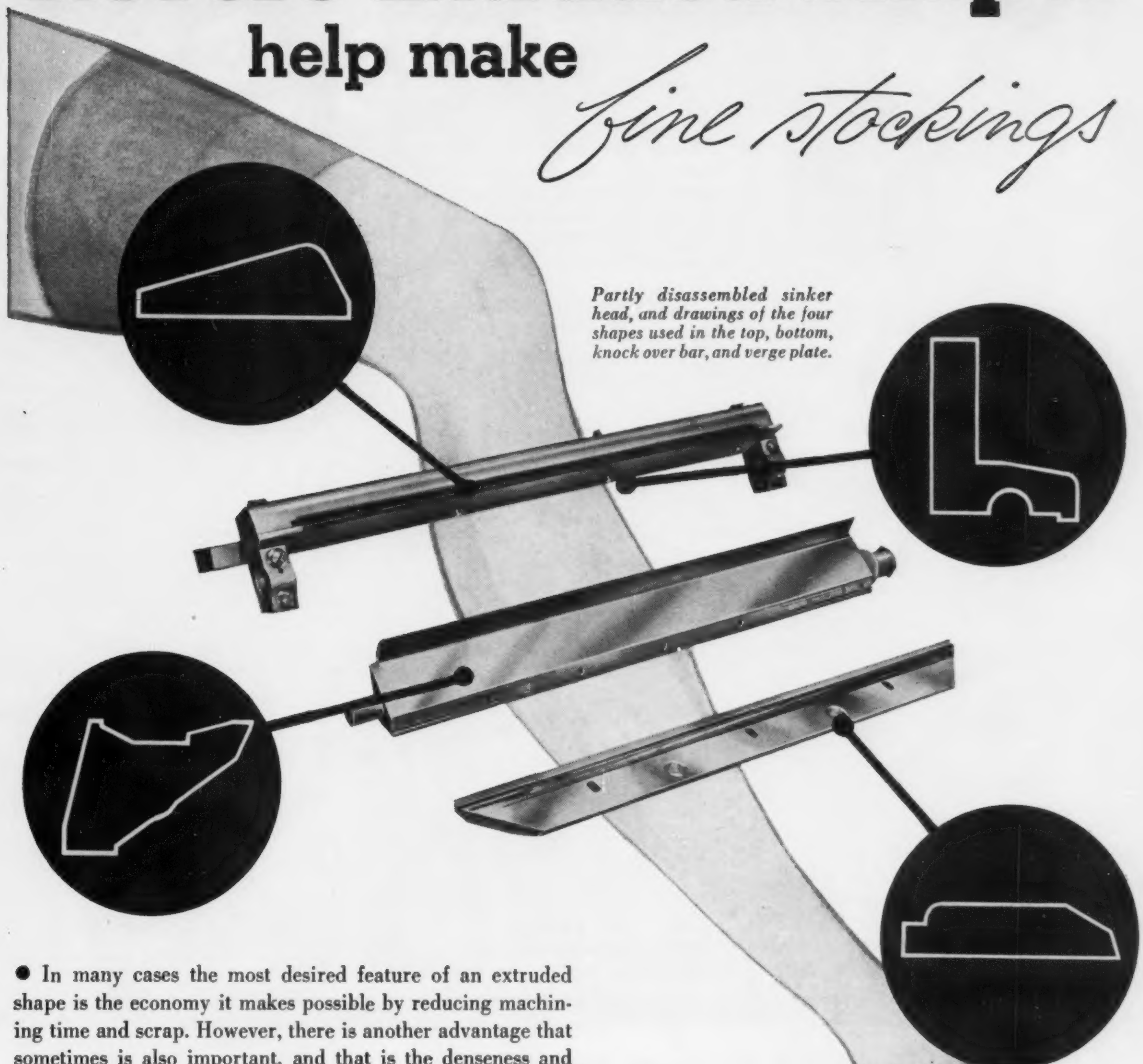


## Instrument for Measuring Machine Speeds

"Celerimeter" developed by Lake Erie Engineering Corporation, Buffalo, N. Y., to make possible the measurement of very high machinery speeds. This portable, easily-operated instrument is designed for measuring the straight-line speed of moving sections of fixed machinery and equipment. It is capable of measuring speeds ranging from 5 inches to 30,000 inches per minute. An example of its use is the determination of the proper shot-plunger speed of a die-casting machine. After adjustments are once made to produce the best casting, thereafter the shot-plunger can be regulated through the use of the "Celerimeter" so that castings will not be spoiled in making trial shots. The "Celerimeter" unit weighs 26 1/2 pounds, is supplied in a rugged case, and operates on 110-volt, 60-cycle current.

Circle Item 150 on postcard, page 235

# Revere Extruded Shapes
## help make *fine stockings*



*Partly disassembled sinker head, and drawings of the four shapes used in the top, bottom, knock over bar, and verge plate.*

● In many cases the most desired feature of an extruded shape is the economy it makes possible by reducing machining time and scrap. However, there is another advantage that sometimes is also important, and that is the denseness and uniformity of the metal. A shape is produced by pushing heated metal through a die, in an extruder that exerts an extremely high pressure. This working of the metal imparts extra qualities.

Both economy and uniformity are taken advantage of by the Textile Machine Works, Reading, Pa. The company uses four extruded shapes of Revere Free Cutting Brass in its slotted sinker heads. For 66-gauge stockings, there are 66 slots in a space of 1½ inch, and in the total slotted length of 14 inches, the tolerance is less than .001 inch. In order to achieve this accuracy, and be assured of straightness and flatness, Textile specifies shapes of extreme uniformity.

Perhaps your requirements are not quite so high as Textile's. Or perhaps they are higher. In either case, we shall be glad to explain how Revere Extruded Shapes can save you money, and at the same time help you maintain the highest quality standards. See the nearest Revere Sales Office.

**REVERE**

**COPPER AND BRASS INCORPORATED**

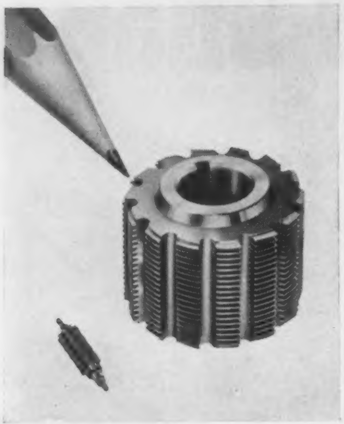
*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, N. Y.

• • •

*Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.*

For more information on products advertised, use Inquiry Card, page 235



## "Illinite" Hobs for Fine-Pitch Gears

The Illinois Tool Works, Chicago, Ill., has announced a completely redesigned line of fine-pitch hobs that meets all of the requirements of the revised ASA standards. In addition, these "Illinite" fine-pitch hobs embody improved design concepts which are said to increase their cutting efficiency and accuracy. Sizes are available for cutting gears ranging from 20 to 120 diametral pitch. They can be had in three bore diameters of 0.315 and 0.750 inch and 1.250 inches. Hobs are available, in each of these three sizes, for cutting gears with a pressure angle of 14 1/2 or 20 degrees. They range in size from 3/4 inch in diameter by 1/2 inch to 2 1/2 inches in diameter by 2 1/2 inches. Fifty-five different sizes are carried in stock.

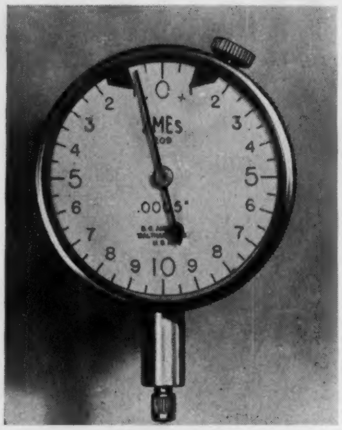
Circle Item 151 on postcard, page 235

## Flange-Mounted Ball Bearings

Flange-mounted, self-aligning ball bearing of a new line designated as the "F100 Series" now being made by the Nice Ball Bearing Co., Philadelphia, Pa. These bearings are designed for machine frame applications in the farm machinery, conveyor, power transmission, blower and fan building industries. They feature an efficient labyrinth composition seal designed to assure retention of lubricant and the exclusion of foreign material, and are available in shaft sizes ranging from 1/2 inch to 1 1/4 inches. Recommended for


medium loads and speeds ranging up to approximately 5000 R.P.M. Mounted in a frame opening of the proper size, the bearing is attached by means of three bolts which are tightened after the shaft has been inserted and aligned.

Circle Item 152 on postcard, page 235




## Tolerance Hands for Ames Dial Gages and Indicators

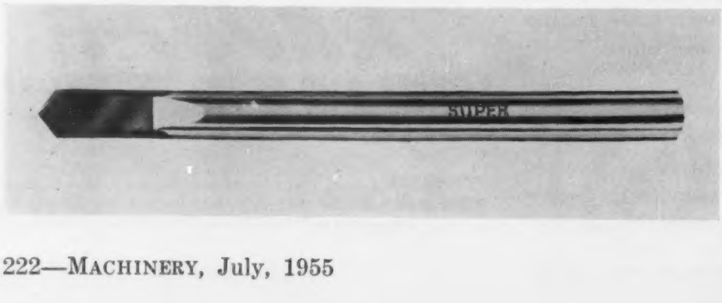
The B. C. Ames Co., Waltham, Mass., is introducing newly designed tolerance hands for use on its line of micrometer dial gages and dial indicators. These tolerance hands are located directly above the dial and under the crystal, which makes the pointers easier to see and eliminates distortion in reading. It also prevents the hands from being moved accidentally. If desired, the indicator can be sealed to prevent unauthorized changing of tolerance limits.

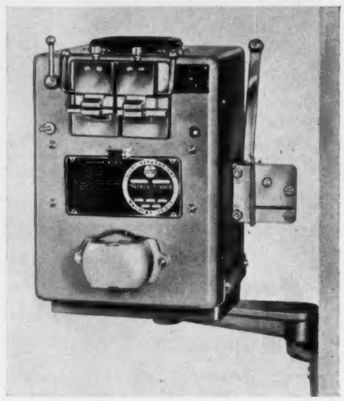
Circle Item 154 on postcard, page 235

## Carbide-Tipped Drill for Cutting Hardened Steel

Improved carbide-tipped drill with hardened high-speed steel body brought out by the Super Tool Co., Detroit, Mich. The extra large solid carbide end of this drill effectively resists destructively high heats generated when cutting hardened steels, extends tool life, and practically eliminates breakage problems. This Type HSC drill is available in twenty-seven sizes, ranging from 3/32 to 1/2 inch, with a round shank. Type H, with a hexagonal body, is provided in sizes from 3/8 to 3/4 inch.

Circle Item 153 on post card, page 235



## Band-Saw Blade Welder

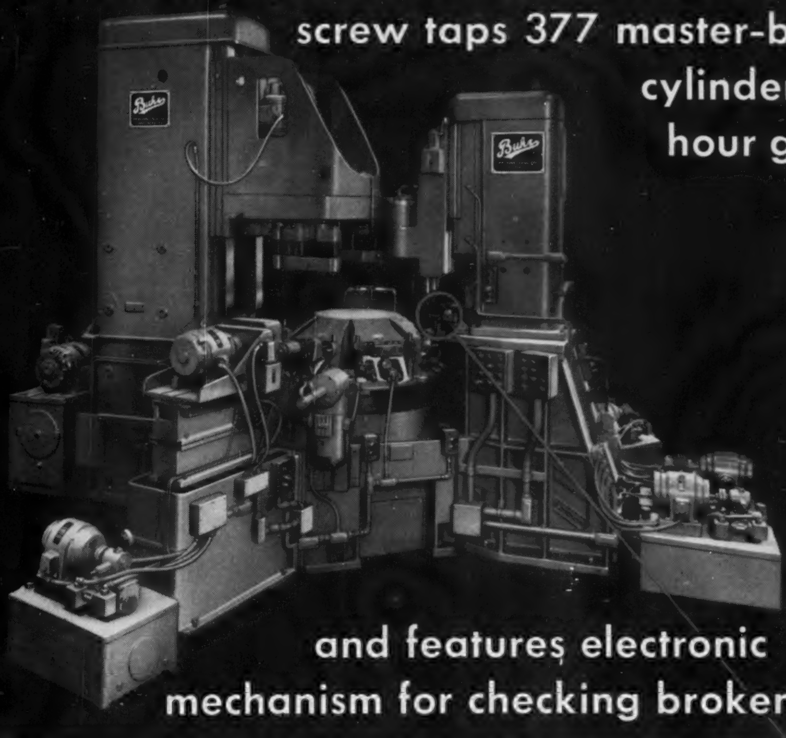
A band-saw welder, which has a capacity of 3/4 inch, brought out by the Walker-Turner Division of the Kearney & Trecker Corporation of Plainfield, N. J. This unit will butt-weld a band-saw blade in less than two minutes. Its features include quick, easy operating, adjustable heavy-duty blade clamps with cam locks

ANOTHER EXAMPLE of
REDUCING COSTS WITH—

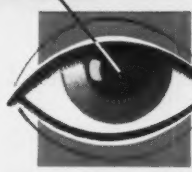
# Buhr

## ECONOMATION

Drills, chamfers, spot-faces and individual-lead-screw taps 377 master-brake cylinders an hour gross....



and features electronic mechanism for checking broken drills!



This 7-way dial-type hydraulic-feed Buhr Special has a 48″-diameter 7-position power-operated index table, complete with shot bolt. Two parts are loaded per station in each of its seven fixtures. Automatic clamping of fixtures is performed by a power-wrench with torque control.

Electronic mechanism automatically checks two .028 drills. Following each cycle, drill-checking arms swing sensing probes to and from drills. If either drill is broken, special electronic sensing-circuit stops machine and flashes failure-light.

Buhr

MULTIPLE-SPINDLE
HIGH PRODUCTION MACHINERY

*Find out how Buhr Economation can reduce your production costs. Phone, wire or write us. A consultation with one of our top sales executives will be arranged promptly!*

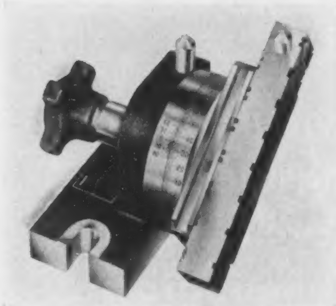
**BUHR MACHINE TOOL CO.**

ANN ARBOR, MICHIGAN

Solidly Engineered • Precision Built • for World's Leading Manufacturers

and a built-in flash grinder. The 115-volt model illustrated has a cut-off shear. A 230-volt model is also available. Although primarily designed for portability, provision is made for attaching the welder to any metal-cutting or wood-cutting band saw.

Circle Item 155 on postcard, page 235



## Versatile Angle-Dresser and Tool-Holder

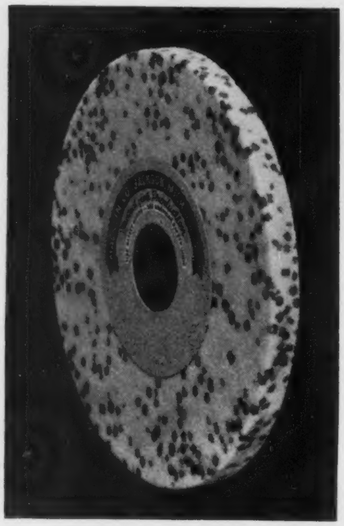
Rothfuss G-2 angle-dresser and tool-holder designed to serve as a diamond holder for dressing grinding wheels to any desired angle and as a holder for grinding lathe and planer tools to the required angles. The angle-dresser has a graduated vernier scale reading from 0 to 180 degrees that can be set to within 5 minutes of 1 degree in one second. Product of Rothfuss Tool Co., Providence, R. I.

Circle Item 156 on postcard, page 235

## Semco Press Brakes

The Service Machine Co., Inc., Elizabeth, N. J., has announced three new 55 Series press brakes designated as Models 55-609 with 6-foot bed bending capacity for 9-gage sheet material; Model 55-811 with 8-foot bed bending capacity for 11-gage material; and Model 55-1012 with 10-foot bed bending capacity for 12-gage material. The ram and lower bed of these presses are made of heavy welded-steel construction. The brake and clutch are of the disc type and the brake has a lining that is simple to adjust and may be replaced without dismantling the entire unit. The presses are double-geared and twin-driven for balanced distribution of power. A 5-H.P. motor is standard equipment on all models. They have a high-torque motorized ram adjustment, 3-inch stroke, 5-inch ram adjustment, 9 1/2-inch depth of throat, and 14-inch shut height.

Circle Item 157 on postcard, page 235



## Aluminum Oxide Wheels for Hard-to-Grind Steels

M. M. process aluminum oxide wheel made by Macklin Co., Jackson, Mich. The fine abrasive grain in pellet form, distributed throughout the wheel, is said to give a constant flow of fine abrasive between the wheel and the work. The resulting self-dressing action saves time and makes a particular grade of this wheel adaptable to a wider range of materials. Cool cutting action, fast stock removal, and exceptionally long life enable the wheel to perform many difficult grinding jobs effectively. Although particularly outstanding for surface grinding, it is also being successfully applied to internal and external grinding.

Circle Item 158 on postcard, page 235

## End Mount for Hydro-Line Hydraulic Cylinders

The Hydro-Line Mfg. Co., Rockford, Ill., recently introduced this end mount for its standard hydraulic cylinders used on machine tools. The mount complies with JIC standards and is designed especially for use on machine tools with long sliding beds. It can be easily and quickly removed with a minimum of down time.

Circle Item 159 on postcard, page 235

## "Em-re" Dial Indicator

One of twenty-four different models of "Em-re" dial indicators now available from Petz-Emery, Inc., Pleasant Valley, N. Y. These indicators are made with graduations of 0.0001, 0.00025, 0.0005 or 0.001 inch and with ranges from 0.025 to 0.250 inch. All conform to American Gage Design specifications and have a bezel diameter of 2 1/4 inches. The fully jeweled

and completely shockproof movements of these indicators are designed to give accurate, repeat readings on production inspection jobs as well as on critical laboratory work. Those who service their own indicators need not keep a large stock of parts since the entire line of twenty-four models is built around only thirty-one parts. All but six parts are common to all models. By merely substituting a rack gear, an intermediate gear, and the dial, any "Em-re" dial indicator with a range of 0.100, 0.075, 0.050, or 0.025 inch can be changed to any one of the eighteen other models in these ranges.

Circle Item 160 on postcard, page 235

For more information on products advertised, use Inquiry Card, page 235


# Between Grinds

By E. S. Salichs

## Congratulations to a Contemporary

*Iron Age* has just celebrated the One Hundredth Anniversary of its founding. In 1855, it was begun as the *Hardwareman's Newspaper* by John Williams.

## Landmark with a Future

New York City will now have a huge hard goods merchandise mart patterned after the one in Chicago, to be established on the John Wanamaker Broadway store properties. The machine tool industry will be represented in this trade center and continuous exhibit, along with the electrical supply, housewares, hardware, and appliance industries. The facades of the building John Wanamaker acquired in 1896 will be retained.

## Hail a Copter

Things will be popping and people hopping at the two giant shows—Machine Tool and Production Engineering—in Chicago this September 6 to 17. There will be a scheduled helicopter service between the International Amphitheatre, stage for the Machine Tool Show, and the Navy Pier, scene of the Production Engineering Show. More than 100,000 executives are expected for the concurrent events.

## Red Scales in the Sunset

An automatic fish scaler in a power kit, designed by the American Homecraft Co. to make the fruits, or fish, of your hobby less of a chore, is on the market. You can scale a fish five times faster than in the old days, assuming, and why not, that you catch one.

## Reverse

We were surprised recently to see a new automobile on the road with its name misspelled on the trunk. PNOTIAC announced to the world that the assembly line had pulled a bnoer, boner, that is.

## Not the Fair Way

One of the book editors of MACHINERY'S HANDBOOK—H. H. Ryffel—has been trying to break par on the golf course for a year or two, putting a wager on it as well with us. An article he wrote on die-casting recently appeared in the French journal, *La Machine Moderne*, with the by-line "Par H. H. Ryffel." On these grounds he tried to collect his bet.

## What a Switch—Snacks to Snaps

Noiseless mercury switches are given a forty-eight-hour rest period after manufacture, since any sluggishness caused by moisture in the mercury tube will then show up. The Micro Switch Division of the Minneapolis-Honeywell Co. found an ideal place to hold the switches: a cheese-aging room formerly used by a dairy manufacturer in Freeport, Ill.

NOT BY CHANCE—did Manuel C. Sanz write the leading article in June MACHINERY entitled "Chem-Mill on a Production Basis at North American." For he is group leader of materials research and process development there and in this capacity directed development of the unique process. Mr. Sanz was born in Mexico City in 1909 and in due time received a B.S. degree in chemical engineering and then an M.S. in chemistry and physics at the University of Southern California. Before joining North American Aviation, Inc., in 1946, he conceived a means of making the bulletproof fuel tank for combat aircraft. He also made the first mono-propellant liquid rocket missiles in the United States. The family fired these in the desert areas not far from Los Angeles. To show that the Chem-Mill process has applications outside the aircraft and missile field, Mr. Sanz recently Chem-Milled a baton for his eleven-year-old son, Tony, who leads the school band. And in the picture, he is showing a Chem-Milled steering wheel to a most attractive employe at the Downey plant. Who wouldn't!

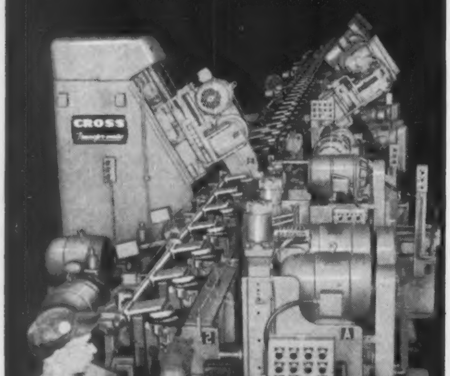

Mills
and Drills
2 and 4 Barrel
Intake Manifolds
Another Special by Cross
CROSS
CROSS
CROSS
★ Rough and finish mills mounting faces; mills, drills and chamfers water outlet pad.
★ 145 pieces per hour at 100% efficiency.
★ 7 stations: 1 loading, 4 milling, 1 drilling and 1 chamfering.
★ Hydraulic power clamping for work holding fixtures.
★ Automatic retraction for milling cutters.
★ Cross-Drive for milling cutters.
★ Pre-set tooling throughout.
★ Gravity operated cam clamping for indexing table.
★ Other features: Hardened and ground ways; hydraulic feed and rapid traverse; complete interchangeability of all standard and special parts for easy maintenance; Construction to J.I.C. standards.
Established 1898
THE CROSS CO.
DETROIT 7, MICHIGAN
Special MACHINE TOOLS

# Warner Gear Reduces Downtime with Cross Machine Control Unit

*A Mechanical Eye . . .*

TO WATCH YOUR TOOLS


*At right, set-up man pre-sets tools at Warner Gear Division, Borg-Warner Corp. for Transfer-matic below.*




**"We are well satisfied with the results we have obtained from the Cross Machine Control Unit," says Emory Watson, Master Mechanic of Warner Gear Division of Borg-Warner Corporation.**

**Warner Gear's experience is typical of many users. Over 500 Cross Machine Control Units are successfully reducing costs of many metal cutting operations. Here's why:**

**Toolometers on the Machine Control Unit assure improved tool changing programs and maximum tool efficiency. Tools—pre-set with standard fixtures and gages to eliminate machine adjustments and trial cuts—are stored in the Machine Control Unit convenient and ready when needed. Results: Reduced tool costs . . . less downtime . . . higher operating efficiency.**

**You can get the same cost saving benefits as Warner Gear. Write, wire or phone The Cross Company for full information, today.**

*Established 1898*

**THE CROSS CO.**

DETROIT 7, MICHIGAN

*Special* MACHINE TOOLS




For more information on products advertised, use Inquiry Card, page 235

# News OF THE INDUSTRY

## California, Texas, and Colorado

ONSRUD MACHINE WORKS, INC., Chicago, Ill., announces that DAYTON & BAKEWELL, Los Angeles, Calif., has replaced FRANK E. JONES MACHINERY CORPORATION in Los Angeles as metal-working machine tool representative in the following Southwestern territories: Southern California, Arizona, Nevada, and New Mexico. FRANK E. JONES will continue to represent Onsrud's line of woodworking machine tools.

EDWARD D. JACKSON has been appointed general sales manager of the Axelson Mfg. Co., Division of U. S. Industries, Inc., Los Angeles, Calif.

Edward D. Jackson, general sales manager, Axelson Mfg. Co., Division of U. S. Industries, Inc.

He will direct the national and international sales operations for the company's products. Mr. Jackson will make his headquarters at Axelson's main office in Los Angeles.

SHERIDAN-GRAY, INC., design and development division of T. W. & C. B. Sheridan Co., New York City, recently moved into its new quarters at 24701 Crenshaw Blvd., Torrance, Calif.

WESTERN GEAR WORKS, Lynwood, Calif., announces the election of the following officers: BERNARD J. BANNAN, who has been general manager of the company's six plants, is now vice-president in charge of operations; L. A. MYHRE, who has been assistant general manager in charge of marketing, is vice-president in charge of marketing; and PAUL MEHREN, formerly controller, is now secretary-controller.

JOHN BERMINGHAM has been made western sales manager for E. F. Houghton & Co., Philadelphia, Pa. He succeeds W. A. FLETCHER, who died recently. His headquarters will be located at the West Coast plant which is at 1500 Davidson Ave., San Francisco, Calif.

CLEAVER-BROOKS CO., Milwaukee, Wis., announces the appointment of the POWELL EQUIPMENT CO., Houston, Texas, as manufacturers' representative for the sale of Cleaver-Brooks boilers and equipment. Located at 7623 Greenstone in Houston, its territory will include twenty-nine counties in southeast Texas surrounding Houston.

R. H. WITTBOLD CO., Houston, Texas has been appointed representative for the sale of Wheelco industrial instruments and combustion safeguards for the Wheelco Instruments Division. Barber-Colman Co., Rockford, Ill. SWIECO, INC., Fort Worth, Texas, has been appointed representatives for the company in the Forth Worth area.

FIRTH STERLING, INC., Pittsburgh, Pa., has appointed the following distributors for their products: TRI-TEX MACHINE & TOOL CO., 831 S. 75th St., Houston, Tex., and the SOUTHWEST INDUSTRIAL SALES CO., 2526 Mockingbird Lane, Dallas, Tex.

WILLIAM O. HALL has been appointed chief field engineer of the C. A. Norgren Co., Englewood, Colo. He has been associated with the firm for the past five years.

## Illinois, Indiana, and Missouri

BRYANT MACHINERY & ENGINEERING CO., Chicago, Ill., announces the following executive appointments: CHARLES B. TANSLEY has been elected president; MARTIN J. WIORA, former president, has been appointed to the newly created position of chairman of the board; R. A. COLE has been made vice-president; D. F. LAFFEY has been made vice-president and secretary; and M. J. WIORA, JR., has been elected treasurer.

GEORGE K. LANE has been appointed general manager of Ipsenlab of Ipsen Industries, Inc., Rockford, Ill. In addition to his managerial duties, he will continue to represent Ipsen Industries as a sales engineer for the Rockford territory.

OLSON FILTRATION ENGINEERS, INC., Chicago, Ill., and INDUSTRIAL FILTRATION CO., Lebanon, Ind., distributors of Delpark industrial filters, announce the signing of a franchise authorizing Delpark as sales representative for the Olson pressure type filters.

WILTON TOOL MFG. CO., INC., recently moved from its Chicago, Ill., location to 9525 W. Irving Park Road, Schiller Park, Ill.

JACK L. MODRICH has been appointed executive vice-president of the Hydro-Line Mfg Co., Rockford, Ill. Mr. Modrich joined the organization last year.

ARTHUR E. MAHA has been appointed sales manager of the Link-Belt Co., Dodge Plant, Indianapolis, Ind. He succeeds G. HAROLD WOODY, who passed away recently after thrity-one years with the company.

LINCOLN ENGINEERING CO., St. Louis, Mo., has announced the appointment of CARL H. MUELLER as vice-president in charge of engineering and JOHN E. RENNER as vice-president in charge of sales. Both men have been associated with the company for twenty years.

## Michigan, Minnesota, and Wisconsin

ALLIED PRODUCTS CORPORATION, Detroit, Mich., has recently completed and occupied a new plant in Redford Township, west of the Detroit city limits. The building serves as headquarters for the company's Richard Brothers Punch Division and Hercules Punch Division. Allied vice-president LELAND E. COULTER continues in charge of these divisions and RAYMOND J. WILDS, as assistant sales manager. Recently promoted to assist Mr. Coulter on a divisional level are J. T. MORIARTY, assistant sales manager, JOHN F. NEWCOMB, chief engineer, and REID D. FERRALL, office manager. GEORGE E. GILES has been made plant superintendent.

Jean Raeburn, N.Y.

Jean Raeburn, N.Y.

(Left) R. C. Mahon, chairman of the board; (right) Walter F. Sheetz, president of the R. C. Mahon Co.

R. C. MAHON, founder and for forty-three years president of the R. C. Mahon Co., Detroit, Mich., has been elected chairman of the board. WALTER F. SHEETZ, executive vice-president and sales manager for many years, has been elected to succeed Mr. Mahon as president.

WESSON CO., Detroit, Mich., announces the construction of a new building to be located on a site adjacent to its Detroit plant. It will house complete facilities and personnel of the research and development departments. Several new research programs will be initiated.

HYDRA-FEED TOOL CORPORATION, Ferndale, Mich., announces that sales and service for their line of automatic lathes in Indiana and northern Kentucky will be handled by G. A. RICHEY & SONS CO., Indianapolis, Ind.

TEER, WICKWIRE & CO., Jackson, Mich., announces the purchase of the LINDBERG AIR AND HYDRAULIC CYLINDER DIVISION from LINDBERG ENGINEERING CO., Chicago, Ill.

R. F. PARKER, formerly a sales manager, has been appointed manager of carbide component sales for Carboloy Department of General Electric Co., Detroit, Mich.

RODERICK L. SMITH has been appointed an abrasive engineer in the Minneapolis, Minn., area by Norton Co., Worcester, Mass. He succeeds W. GROVER SNOW, who has retired after nearly forty years' service with the company.

SALES SERVICE MACHINE TOOL CO., 2363 University Ave., St. Paul, Minn., has been named sales representative for HYDRA-FEED MACHINE TOOL CORPORATION, Ferndale, Mich.

ROBERT S. STEVENSON has been elected president of Allis-Chalmers Mfg. Co., Milwaukee, Wis. He succeeds the late WILLIAM A. ROBERTS. Mr. Stevenson started with the company in 1933 as a salesman in the Kansas City branch office of the Tractor Division. In 1951, he was appointed vice-president in charge of the Tractor Division; in 1952, he was elected executive vice-president of the company. Besides his present appointment, Mr. Stevenson is also a member of the executive committee of the board of directors.

RALPH W. BURK, former vice-president in charge of sales and manufacturing for the Kearney & Trecker Corporation, Milwaukee, Wis., has been elected executive vice-president. RAYMOND L. BISCHOFF was made financial vice-president.

Ralph W. Burk, executive vice-president of Kearney Trecker Corporation

BELOIT TOOL CORPORATION, Beloit, Wis., has announced the acquisition of a plant in Beloit which will be operated by their Regal Division for the manufacture of high-speed ground thread taps to be distributed through cutting tool specialists. The company was organized January 1955 by KENYON Y. TAYLOR, J. W. OLIVER, and H. R. ODELL.

## New England

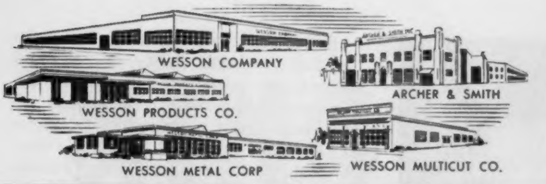
FRANK U. HAYES, vice-president of The Bullard Co., Bridgeport, Conn., has been elected assistant general manager. Mr. Hayes who has also been sales manager since 1947, joined the company in 1935.

DOUGLAS H. THOMSON has been elected president of The E. Horton & Son Co., Windsor Locks, Conn., succeeding ROBERT S. COOPER who recently resigned. Mr. Thomson has served the company since 1948 as vice-president and secretary.

FRANK J. KEARNS, formerly vice-president in charge of engineering of the Bridgeport Brass Co., Bridgeport, Conn., has been named to the newly created post of vice-president in charge of manufacturing.

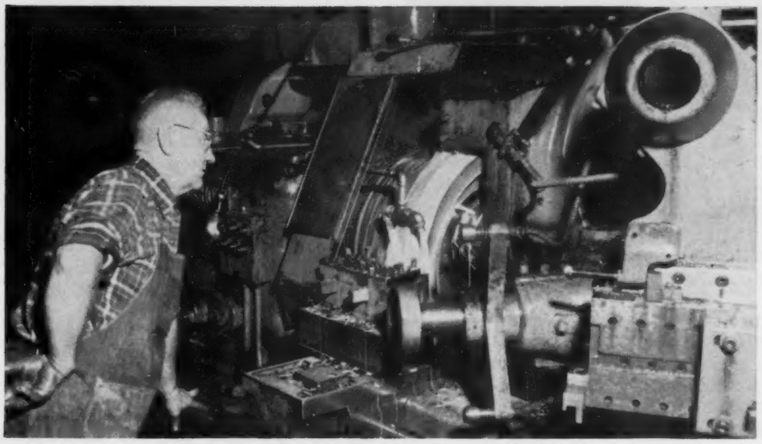
AMERICAN CHAIN & CABLE CO., INC., Bridgeport, Conn., announces the following executive changes: CYRUS N. JOHNS, president, has been elected chief executive officer. Mr. Johns succeeds WILMOT F. WHEELER, who will continue as chairman of the board. STANLEY MANN, who retired as treasurer after forty years of service, was named treasurer emeritus and will continue as a director. ARTHUR C. LASKE, secretary of the company, succeeds Mr. Mann as treasurer and continues as secretary. WILMOT F. WHEELER, JR., has been elected vice-president

Cyrus N. Johns, chief executive officer of American Chain & Cable Co., Inc.

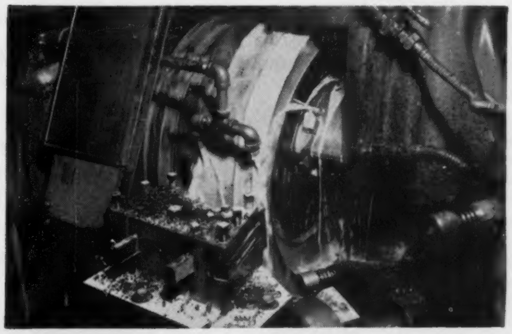



carbide NEWS

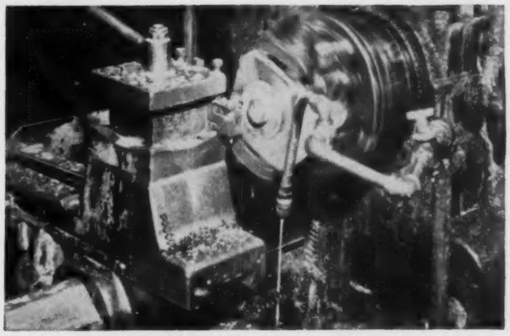
# New Grade 26 Nearly Universal



*Straddle facing the O. D. of a forged steel final drive gear on a 4F Gisholt Fastermatic lathe using Wessonmetal Grade 26. Tool life increased 40% over other carbides.*



◀ *Closeup of straddle facing operation. Two solid carbide Grade 26 inserts are used. Job is being done at 260 sfm and 40 rpm. Feed varies from .017" to .020" with average depth of cut from 3/16" to ¼".*



◀ *Grade 26 produced a 30% increase in tool life on a severe interrupted cut on a tractor brake band anchor. Standard Wesson band-type Multicut is used on a Warner & Swasey turret lathe. Cutting speed ranges from 280 sfm down to zero. Feed is .027", depth of cut is ⅛".*

tools Wesson
carbide Wessonmetal

## Useable on 95% of steel cutting operations, it boosts tool life 40%

The nearest approach to a universal cutting grade available to the metalworking industry is a new carbide designated as "Grade 26" by Wesson Metal Corporation. Created primarily for all types of steel rough and semi-finish machining, it is also proving highly effective on some finishing operations.

Problems of carbide selection are greatly simplified by Wessonmetal Grade 26, since it cuts down the number of grades required for steel cutting operations by as many as four grades.

Optimum performance for Grade 26 extends over a range of 100 to about 400 sfm, covering 95% of steel machining operations encountered in industry today.

Much of Grade 26's record of outperforming all other steel cutting grades in 95% of all machining operations on which it has been applied is due to its superior edge cutting strength. Grade 26 was developed to have high red hardness and high thermal conductivity in order to function without any drop in performance at the elevated temperatures generated at high cutting speeds.

Improvement in tool life over all other grades has averaged about 40% on applications to date. Extensive tests have been conducted on a wide range of materials ranging from conventional steels to the high alloys used in high temperature applications.

Now in full production at Wesson Metal Corporation's new metals plants in Lexington, Ky., Grade 26 provides the answer to lower tool costs over a broad range of metal cutting operations.

For answers to your machining problems write:
WESSON COMPANY
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Detroit 20, Michigan.

For more information on products advertised, use Inquiry Card, page 235

MASSACHUSETTS GEAR & TOOL CO., Woburn, Mass., announces the following executive changes: JOSEPH CAVICCHI, only surviving founder and present treasurer and superintendent of the company, has retired from active management. He will continue as chairman of the board of directors, as a stockholder, and will serve as an advisory consultant. JOHN H. LYMAN will become treasurer, retaining his duties as president of the company as well.

NORTON CO., Worcester, Mass., has made the following changes in its sales organization: HARLAN W. COBB has been appointed a field engineer in the New England and New York State territory. ALFRED C. WOMER replaces Mr. Cobb as abrasive engineer in the northern Ohio area. Mr. Womer was formerly a field engineer in the Cleveland district office.

POTTER & JOHNSTON CO., Pawtucket, R. I., subsidiary of Niles-Bement-Pond Co. of West Hartford, Conn., announces the following executive appointments: EDWARD P. GILLANE, vice-president and general manager, has been named president, general manager, and a member of the board of directors. He has been associated with the company since 1948. WILFRED J. PENDER, factory manager, has also been elected vice-president. Mr. Pender is a veteran of thirty-two years service with the company.

DIXON SINTALOY, INC., Stamford, Conn., announces the appointments of L. B. BURNHAM and W. G. FIENEMAN as the company's New England sales agents.

ALPHA CORPORATION, Stamford, Conn., has changed its name to ALPHA MOLYKOTE CORPORATION.

HOWE & FANT, INC., East Norwalk, Conn., moved into a modern one-story plant at 20 Fitch St.

## New York

JOHN F. ROBB and VERNON H. PATERSON have been appointed to executive positions in the sales department of Climax Molybdenum Co., New York City. Mr Robb now serves as the company's representative to producers and users of molybdenum-bearing alloy steels. His headquarters are in Pittsburgh, Pa. Mr. Patterson is responsible for the national sales of molybdenum to the foundry industry. His headquarters are in New York.

HOWARD S. BUNN has been elected executive vice-president and a member of the executive committee of the Union Carbide and Carbon Corporation, New York City. Mr. Bunn has been a member of the organization since 1922.

Russell M. Wheeler, chief engineer of the Seneca Falls Machine Co.

RUSSELL M. WHEELER was made chief engineer of the Seneca Falls Machine Co., Seneca Falls, N. Y. JOSEPH SAWITZKE, formerly superindendent of Hendey Machine Co., was made manufacturing engineer.

JAMES J. REYNOLDS has been named vice-president of operations of Alco Products, Inc., Schenectady, N. Y. He will be in charge of all manufacturing, procurement, and material control operations, as well as employes services, and industrial relations. JOHN THOMAS has been appointed assistant to the vice-president of engineering of the company and will be located in the engineering headquarters in Schenectady.

ENGELBERG HULLER CO., Syracuse, N. Y., announces the appointment of the following sales engineers: CECIL E. GORDON, southwestern territory; CHARLES VERGAN, central territory; GLENN D. SWANDER, southeastern territory; J. D. KRAEGER, west coast territory; EARL WHITT, mid-Atlantic territory; HOWARD MILLER, east central territory; CHARLES MURPHY, northeastern territory; and HARVEY RAMSEY, Canadian territory.

J. L. OSGOOD MACHINERY & TOOL CO., Buffalo, N. Y., recently formed an affiliate, the OSGOOD MACHINERY, INC., to distribute machine tools presses, and production equipment in the Syracuse, N. Y. area. A. L. MIKULEC has been made president; CARL E. LINDEN, JR., has been made vice-president and general manager.

AMERICAN LOCOMOTIVE CO., New York City, approved a change in name of the 118-year old concern to ALCO PRODUCTS, INC. The company has been in operation since 1837 and the new name has been adopted to reflect the company's diversified operations.

SERVOMECHANISMS, INC. formerly located at Garden City, N. Y., has moved its executive offices to the Eastern and Western Divisions of the company. The Eastern Division is located at Post and Stewart Aves., Westbury, N. Y., and the Western Division at 12500 Aviation Blvd., Hawthorne, Calif.

EDWARD W. SPARKS has been appointed manager of the Syracuse, N. Y. branch of Crucible Steel Company of America, Pittsburgh, Pa. He has been employed at Crucible since 1935 and in 1947 he was made sales service engineer, the position he held until his present appointment.

OAKITE PRODUCTS, INC., New York City, manufacturers of specialized industrial cleaning and related materials, has announced the formation of an Export Division to handle the distribution of their products in Latin America and overseas. HARRY V. KERKER has been appointed manager.

HENRY R. MERRILL has been appointed general sales manager of the Norton Co. Behr-Manning Division, Troy, N. Y. Mr. Merrill, a director of the Division and its assistant general manager for the past two years, succeeds the late JOHN M. COOK.

NORMAN L. DEUBLE has been appointed manager of the newly created Metallurgical Development Division of Climax Molybdenum Co., New York City. Mr. Deuble joined the company in 1947.

VANADIUM CORPORATION OF AMERICA, New York City, has opened purchasing headquarters at 420 Lexington Ave.

## Ohio

E. W. BLISS CO., Canton, Ohio, has formed a new division called the DIE SUPPLY DIVISION with plant and general offices in Cleveland, Ohio. It was formerly known as the Die Supply Co. The division will continue to market Dieco die sets, die springs, and a full line of other diemakers' supplies.

ELLERBUSCH INSTRUMENT SERVICE, 2503 Fairview Ave., Cincinnati, Ohio, has been appointed by the B. C. AMES CO., Waltham, Mass., as their exclusive sales representative for the Cincinnati, Ohio, and Louisville, Ky., area.

CLEVELAND INSTRUMENT CO., Cleveland, Ohio, announces the appointment of DAVID M. GASKILL as sales manager and ROBERT F. BASKIN as manufacturing manager in charge of engineering and production.

(*This section continued on page* 240)

For more information on products advertised, use Inquiry Card, page 235

# PRODUCT INFORMATION SERVICE

**Use postage-free Business Reply Cards for further information**
**On New Catalogues described in this issue of MACHINERY**
**On products mentioned in the editorial pages**
**On products shown in the advertisements**

## NEW CATALOGUES

**GANG-SLITTING EQUIPMENT**—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Circular 898-S-2, covering both standard and custom-engineered slitters ranging in size from hand-operated, punch-mounted slitters to fully automatic slitting lines. Three basic types of units are discussed; conventional driven slitters, pull-through slitters, and combination slitters. Cutter diameters of the units cover a range from 3 to 16 inches. Catalogue provides specification tables and can be obtained on company letterhead request direct to the above address.

**MACHINERY REPLACEMENT AID**—Sundstrand Machine Tool Co., Rockford, Ill. A convenient slide rule to speed computations in MAPI and other machinery replacement formulas. In three steps it is possible to establish (1) the salvage per cent of cost installed; (2) the chart formula determination; and (3) the expected return on investment multiplied by the cost installed. Available directly from above address when requested on company letterhead.

**SIMPLIFIED DRAFTING**—American Machine & Foundry Co., General Engineering Laboratory, 11 Bruce Place, Greenwich, Conn. 36-page booklet on simplified drafting presents eleven common sense rules for simplified drafting practices. The eleven rules are illustrated, and a comparison is made between traditional and simplified methods. This booklet can be obtained on business letterhead request direct to the above address.

**PUNCH PRESSES**—Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. Circular 779-M-4, presenting design, models and construction of Series "E" single-acting, open-back, power punch presses. Included are work samples, construction features, specification tables, and dimension drawings. Can be obtained on business letterhead request direct to the above address.

**PRECISION INVESTMENT CASTINGS**—Crucible Steel Company of America, Pittsburgh, Pa. 16-page booklet entitled "Crucible Accumet Precision Investment Castings," describing the special techniques developed to utilize the relatively new "lost wax" method of precision casting; also featuring three tables listing composition and properties of carbon, low alloy, stainless, high-temperature alloy, and tool steel precision castings; and the magnetic properties of three of the most frequently supplied precision cast Alnico magnets. Examples of uses and a Accumet casting blank are also featured. . 1

**CORROSION- AND HEAT-RESISTANT ALLOY**—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Bulletin A-286, giving detailed performance data on the company's precipitation hardening alloy that develops optimum properties by means of a solution treatment followed by a precipitation hardening or aging treatment. This super alloy is suitable for numerous hot-and cold-working operations, machining, welding, and brazing. It is available in the form of billets, forgings, bars, rod, wire, plates, sheet, strip, and seamless tubes in a wide range of sizes and finishes. . . . . . . . . . . . . . 2

**SHAFT VISE**—Producto Machine Co., Bridgeport, Conn. Bulletin featuring a self-centering shaft vice which can handle shafts 3/8 inch to 3 1/8 inches in diameter, designed for holding shafts or spindles when machining keyways, slots or splines. The accurately milled right- and left-hand thread on the operating screw insures equal movement of the two jaws, thus clamping and centering the work properly in the hardened V-block, The vise is made for either vertical or horizontal mounting. Design features, application photographs, and dimensions are included. . . . . . . . . . . . . . . . . . . . 3

**MEASURING TOOLS AND INSTRUMENTS**—L. S. Starrett Co., Athol, Mass. Catalogue 27, the seventy-fifth anniversary catalogue, featuring eighty-five new tools not previously listed, plus all other additions of mechanics' hand measuring tools and precision instruments, steel tapes, steel rules, dial indicators, dial gages, hacksaws, band saws, band knives, and precision-ground die and flat stock. Illustrations show the tools in detail and the booklet is sectionized, indexed, and cross-referenced for easy selection. . . 4

**POLISHING AND BUFFING**—Russell H. Burns Compound Co., Middlesex, N. J. 2-page data sheet listing compounds made by the company for precision finishing of metals, plastics, wood, celluloid, hard rubber; and including polishing compounds for operations ranging from deburring and chamfering to fine finishing of chrome plate and cutlery. Line of buffing rouges for cut and color on jewelry, sterling or silver plate precision steel dies is also described. . . . . . . . . . . . . . . . . 5

**SLIP ROLL-FORMING MACHINES**—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 77D, containing 18 illustrated pages on the company's line of power and hand-operated slip roll-forming machines (Series 6, 4, 3, 2, and 1 1/2 inches, and 1 inch). Detailed information and specifications are given for each of the models and an explanation of the factors affecting the selection and operating of the machines with special attachments available. . . . . . . . . . . 6

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**FINE-PITCH HOBS**—Illinois Tool Works, Chicago, Ill. 18-page revised booklet of fine-pitch hobs covering completely the American Standard 20-degree involute fine-pitch system. Some of the subjects covered include factors which determine minimum hob radius, fine-pitch hob tolerances, inspection of fine-pitch hobs, and hob sharpening. Booklet also provides information on non-standard fine-pitch hobs and on non-involute hobs. .......... **7**

**INTERNAL GEAR-SHAVING MACHINE**—National Broach & Machine Co., Detroit, Mich. 8-page Bulletin S-55-4, describing the Red Ring Model GCR-12 inch internal rotary gear-shaving machine. Production advantages, design features, and machine operation are described in detail, with close-up photographs and line drawings. A typical operating cycle is described and complete specifications are given for the machines. .......... **8**

**HOLE FINISHING**—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. 4-page Circular 584, explaining the outstanding advantages of hole finishing with carbide burs; telling how to select the right bur and how to determine the optimum maching conditions for a specific hole-finishing job; and discussing evaluation of material, hardness, hole diameter, production and tolerance requirements. .............. **9**

**INVERTED MECHANICAL PRESSES**—Expert Welding Machine Co., Detroit, Mich. Bulletin EW-3, containing 2 pages on a new line of inverted mechanical presses for a wide variety of spot- and projection-welding operations. Design features are described and illustrated with cut-away views, and specifications are listed for standard 32-, 42- and 60-inch wide platen models having fixed adjustable strokes of 5, 6 and 8 inches ........ **10**

**DATA BULLETIN OF STEEL TERMS**—LaSalle Steel Co., Chicago, Ill. Bulletin 6, a 32-page dictionary of cold-finished steel terms entitled "Simplified Steel Terms and Engineering Data." Included are more than 180 relatively detailed definitions frequently used in the purchase, manufacture, treating, machining, and finishing of steel. There are more than thirty photographs, curves, and tables which cover a variety of subjects. .. **11**

**GAGE BLOCKS**—Ellstrom Standards Division, Dearborn Gage Co., Dearborn, Mich. 8-page illustrated catalogue containing complete specifications and prices on the company's line of chromium-plated gage-blocks, presented in single-page tabular form. Ellstrom standards are offered in twenty-eight standard block sets ranging from eight to ninety-two pieces with, or without, selected basic gage-block accessories. ...................... **12**

**CENTERS FOR LATHES**—Ready Tool Co., Bridgeport, Conn. Catalogue L-55-1, featuring all types of centers for lathes and describing the Red-E double-row bearing-assembly centers. Engineering information relative to the basic bearing designs, and other technical information is also given. The catalogue covers shank, spindle, bull and pipe type centers with complete specifications and prices. .. **13**

**DIAL INDICATORS**—Petz-Emery, Inc., Pleasant Valley, N. Y. Bulletin 455, containing 4 pages on the fully jeweled, shock proof movements of Em-re dial indicators, giving accurate, repeated readings on any application from production inspection to laboratory measurements. The complete line of twenty-four models is built around only thirty-one parts. All but six parts are common to each model. ........................ **14**

**UNIVERSAL JOINT**—Gear Grinding Machine Co., Joint Division, Detroit, Mich. Catalogue sheet containing information on the new constant velocity universal joint for small applications with the Rzeppa "OV." This new miniature is designed for applications which demand compactness and ruggedness. It consists of a spherical or cylindrical outer driving member and hardened steel balls rolling in grooved raceways. ............. **15**

**DIE SPRINGS**—Danly Machine Specialties, Inc., Chicago, Ill. 16-page catalogue describing the company's line of die springs, including minimum pressure, medium-high pressure and high-pressure die springs. A simplified method of spring selection is given, as well as tables that convert compressed length to free length for three types of springs and show load for various degrees of compression. .. **16**

**SOLENOID VALVES**—Skinner Electric Valve Division, Skinner Chuck Co., New Britain, Conn. Catalogue D1, containing 51 pages on the company's solenoid valves, including universal, all-purpose, four-way, miniature cut-off, high-pressure hydraulic, high-flow industrial, and special valves. Definitions and reference tables, current and flow data, and conditions of sale are covered. ......... **17**

**RADIANT OVENS**—Fostoria Pressed Steel Corporation, Fostoria, Ohio. Catalogue inserts designated 55-101 and 55-102, explaining the advantages of radiant ovens for industrial drying and baking, and using smaller Fostoria ovens as examples. The following aspects of infrared drying are covered: speed, flexibility, product quality, efficiency, and cost. . **18**

**MACHINING TITANIUM** — Mallory-Sharon Titanium Corporation, Niles, Ohio. 8-page booklet entitled "Machining Recommendations for Titanium," explaining the fundamentals of machining titanium, and giving basic requirements and factors affecting machinability. Turning, milling, drilling, tapping, grinding, and abrasive cutting recommendations are included. **19**

**MACHINE COMPONENTS** — Hartford Special Machinery Co., Hartford, Conn. Bulletin 500, containing 20 pages covering the company's complete line of standardized machine components including hydraulic drill units, automatic cam feed drilling units, lead-screw tapping units, multiple-spindle heads, automatic index-tables and machine bases. ........ **20**

**MAGNETIC-PARTICLE TESTING**—Research & Control Instruments Division, North American Philips Co., Inc., Mount Vernon, N. Y. 8-page booklet covering procedure and describing problems that can be handled on magnetic-particle testing; also explaining prod and coil techniques, current voltage conditions, effects of scale, and portable field work. .. **21**

**SPRING GAGES**—Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. 12-page booklet covering price list and specifications for all sizes and types of bonded resistance wire strain gages; also tells how to select the right gage for various conditions of use. .................. **22**

## Product Information Service

**Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.**

**PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.**

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| 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 |
| 57 | 58 | 59 | | | | | | | | | | | |
| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 |
| 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 |
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| 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 |
| 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 |

**For more details on products mentioned in July editorial or advertising pages, fill in below:**

PAGE ...... PRODUCT ..........................

PAGE ...... PRODUCT ..........................

Please print your name and address

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TITLE ........................................

COMPANY ........................................

CO. ADDRESS ........................................

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This card is void after October 1, 1955

M-7/55

**TURRET PUNCH PRESS**—Wiedemann Machine Co., Philadelphia, Pa. Bulletin 61, containing 14 pages on the company's turret punch press R-61 for small lot and semi-production work, and including production records, time saving principles, operating features, construction details, and work locating gages. Specifications are also included. . . . .**23**

**DIES, JIGS, FIXTURES, AND TOOLS**—Cleveland Tool & Die Co., Cleveland, Ohio. 35-page booklet describing lamination dies; custom lamination stampings; special-purpose dies; precision cutting tools; precision gages, jigs, and fixtures; tungsten-carbide fabrication; custom jig-grinding and boring; special-purpose equipment; precision testing equipment; and compacting dies. . . . . . . . . . . . .**24**

**PUNCHES AND DIES**—Whitney Metal Tool Co., Rockford, Ill. 16-page catalogue showing complete and diversified line of punches and dies. The publication is organized in sections by the maximum hole sizes for various standardized types of punches and covers everything up to 1-inch round holes and 11/16-inch square holes. . . . . . . . . . . . . . . . . . . . . . . . .**25**

**SLING CHAINS**—Columbus McKinnon Chain Corporation, Tonawanda, N. Y. Data Book 100, containing 32 pages on Herc-Alloy sling chains and giving physical properties, certificate of test, specifications, working load limitations, and miscellaneous types of chains. A section on how to order includes size, reach, type and attachments. . . . . . . . . . . . . . . . .**26**

**DIEING MACHINES**—Emhart Mfg. Co., Hartford, Conn. 40-page catalogue including seventy different types of automatic dieing machines and precision power presses and also describing 275 machines produced by the company's four divisions. Detachable business reply cards for each of the divisions form part of the booklet's front cover. . . . . . . . . . . . . .**27**

**PRESS REBUILDING**—E. W. Bliss Co., Canton, Ohio. Bulletin 47, containing 8 pages on how to revitalize older presses through press rebuilding. Specialized facilities and techniques developed by the company are described and illustrated, including documentation on every press manufactured or rebuilt in the last fifty years by Bliss. . . . . . . . . . . . . . . . . . .**28**

**BALANCING MACHINES**—Gisholt Machine Co., Madison, Wis. Bulletin 1165, describing Dynetric Type "S" balancing machines. New punch type and vertical type machines are also covered. One-third of the booklet is devoted to accessories and applications. Specifications, diagrams, and illustrations are included. .**29**

**DILL SLOTTERS**—Lobdell United Division, United Engineering & Foundry Co., Wilmington, Del. 4-page leaflet entitled "The Universal and Standard (Mechanical) Lobdell Dill Slotter," describing the company's tool slotter which is available in two models—universal and standard. Illustrations and specifications are given. . . . . . . . . . . . . . . . . . . . . . . . . . . . .**30**

**STOCK FEED**—Producto Machine Co., Bridgeport, Conn. Bulletin picturing and describing the automatic Surefeed which comes in 2- and 3-inch models and can be mounted right on the die set so that the two units can be handled as one. Design features are given for the hitch feed with specifications and instructions for set-up procedure. . . . . . . . . . . . . . . . .**31**

**STAINLESS FASTENERS**—Allmetal Screw Products Co., Inc., Garden City, N. Y. Brochure P14A, containing 8 pages listing stainless fasteners available through the company, and including style and size data about stainless screws, bolts, nuts, washers, and rivets. Body and head styles are illustrated. . . . . . . . . . . . . .**32**

**VARIABLE-SPEED TRANSMISSION**—Graham Transmissions, Inc., Menomonee Falls, Wis. Bulletin 519, describing the company's Speed Corrector transmission which provides extreme accuracy of speed control over a narrow range. It is a compact unit incorporating both variable-speed drive and built-in differential. . .**33**

**ELECTROLYTIC GRINDING AND SHAPING**—Anocut Engineering Co., Chicago, Ill. Brochure entitled "Automatic Electrolytic Shaping with Electronic Control," explaining in detail the advantages of using standard grinders equipped with electronic controls. Specifications, illustrations, and diagrams are included. . . .**34**

**AUTO-LOAD HOPPER-FEED MECHANISM**—Hi-Shear Rivet Tool Co., Los Angeles, Calif. Brochure describing new Auto-Load hopper-feed mechanism for automatic screw machines which can feed, locate, machine, and eject a wide variety of small pieces. . . . . . . . . . . .**35**

**PRESS BRAKE DIES**—Dreis & Krump Mfg. Co., Chicago, Ill. Pamphlet D-4-55, covering the complete range of standard Chicago induction-hardened press-brake dies and a handy reference for ordering any of a wide range of standard dies for production bending of sheet metal and steel plate on press brakes of any make. . . . . . . . . . . . . . . . . . . . . . . . .**36**

**TOOL HOLDERS**—Vascoloy-Ramet Corporation, Waukegan, Ill. 12-page catalogue VR-435B, describing tool holders for round "Throw-Away" carbide blanks and round 1 1/2-inch carbide inserts. It gives information on a new style toolholder with 35-degree end clearance angle. . . . . . . . . . . . . . . . . . . . . . . .**37**

**BRONZE BUSHINGS, BEARINGS, AND BAR STOCK**—American Crucible Products Co., Lorain, Ohio. 12-page brochure devoted to the company's "Promet" bronze bushings, bearings, bar stock, and babbitt metal. . . . . . . . . . . . . . . . . . .**38**

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**GAGE HANDLES AND BLANKS**—Royal Oak Products Co., Royal Oak, Mich. 8-page catalogue describing all types and sizes of gage handles and gage blanks, including double-end reversible, single-end reversible, Taperlock, Trilock, and spline gage handles. . . . . . . . . . . . . .**39**

**AUTOMATIC CONTROL OF VARIABLE SPEEDS**—U.S. Electrical Motor Inc., Los Angeles, Calif. Bulletin 1882 entitled "Automation Through Varitrol Control," containing 8 pages explaining how pneumatic control has been designed into U. S. Varidrive motors. Typical applications are shown, and schematic drawings explain the process. . . . . . . . . . . . . . . . . . . . .**40**

**DRILL AND LATHE CHUCKS**—T. R. Almond Mfg. Co., Willoughby, Ohio. Bulletin C-255, containing 4 pages on taper arbor-hole drill chucks, threaded arbor-hole drill chucks, drill-chuck arbors, three-jaw non-reversal lathe chucks, and four-jaw independent lathe chucks. Tabulations and specifications are also included. . . . .**41**

**STEEL-CUTTING CARBIDES**—Carmet Division, Allegheny Ludlum Steel Corporation, Detroit, Mich. Bulletin C11, containing 4 pages on CA-600 series of steel-cutting carbides, covering the anti-cratering ingredient called "Crystalloy." Three case records are included. . . . . . . . . .**42**

**GRINDING WHEELS**—Kodiak Corporation, Cleveland, Ohio. 4-page pamphlet, describing the Contourmatic "Constant Diameter" grinding wheel, and explaining how it works, what it does, and how longer segment life is realized with this unit. . . . . . . . . . . . . . . . . . . . . . . .**43**

**HARDENED-STEEL WAYS**—Coes Knife Co., Worcester, Mass. 4-page brochure entitled "Coes Hardened Steel Ways," describing and illustrating the construction, typical applications, and advantages of interchangeable tool steel machine ways. . . . . . . . . . . . . . . . . . . . . . . .**44**

**CARBIDES**—Kennametal, Inc., Latrobe, Pa., Form B-111, containing 22 pages describing the characteristics of Kennametal wear-resistant, heat-resistant cement carbides for a wide variety of demanding applications. . . . . . . . . . . . . . . . . . . . . .**45**

**COOLANT FILTERS**—Industrial Filtration Co., Dept. T-289, Lebanon, Ind. 4-page bulletin describing Delpark coolant filters available for Thompson grinder line, and illustrating four major grinder models equipped with these filters. . . . . . . . .**46**

**CARBIDE TOOLS AND BLANKS**—Adamas Carbide Corporation, Kenilworth, N. J. 16-page price and specification book No. 355, describing the company's line of standard tools and blanks and featuring "Throw-Away" insert blanks. . **47**

**CASTING PROCESS**—Lebanon Steel Foundry, Lebanon, Pa. Bulletin describing new casting process called Ceramicast which utilizes ceramic molds to produce casting. Many advantages of this process are listed. . . . . . . . . . . . . . . . . . . . .**48**

**AIR-CLUTCH PARTS**—Ferracute Machine Co., Bridgeton, N. J. Catalogue CL-2, containing pages of information on air-clutch parts and explaining how to order them. Leaflet contains diagrams and illustrations. . . . . . . . . . . . . . . . .**49**

**FLEXIBLE SHAFT MACHINES**—Wyzenbeek & Staff, Inc., Chicago, Ill. 10-page Catalogue No. 55, describing the company's line of flexible shafts, machines, saw attachments, hole cutters, and related items. . . . . . . . . . . . . . . . . . . .**50**

**STAINLESS STEEL WIRE**—Crucible Steel Company of America, Pittsburgh, Pa. 32-page booklet ADV166, describing Rezistal stainless steel wire, its uses, and the products made from it. . . . . . . . . . . .**51**

**UTILITY UNIT HEATER**—L. J. Wing Mfg. Co., Linden, N. J. Bulletin U-8, describing utility unit heater for general-purpose heating, and giving engineering data, piping and wiring details, dimensions, and weights. . . . . . . . . . . . . . .**52**

**HYDRAULIC CONSTANT-SPEED DRIVES**—General Electric Co., Schenectady, N. Y. Catalogue GET-2480, containing 11 pages on the theory of operation of hydraulic constant-speed drives. Diagrams are included illustrating use. . .**53**

**EPOXY RESIN TOOLING MATERIALS**—Furane Plastics Incorporated, Los Angeles, Calif. Booklet describing tooling material known as "Epocast" and applications such as stretch dies, draw dies, chucks, and jigs and fixtures. . . . . .**54**

**BRAZING AND PROCESSING STAINLESS STEEL**—Wall Colmonoy Corporation, Detroit, Mich. 4-page leaflet describing the special facilities of Nicrobraz, a stainless-steel alloy, including photographs and applications. . . . . .**55**

**PRECISION TOOLS**—Lufkin Rule Co., Saginaw, Mich. Catalogue 8, containing 160 pages on precision tools and illustrated with sectional drawings, application photos, charts, and tables. . . . .**56**

**AUTOMATIC CONTROL EQUIPMENT**—Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. 16-page bulletin discussing conventional millivoltmeter construction and its application to control instruments. . . . . . . . . . . . . .**57**

**PRECISION SURFACE PLATES**—Durant Tool Supply Co., Providence, R. I. Bulletin describing a variety of standard sizes of surface plates available from the company's factory stock and from dealers. **58**

**OPTICAL ALIGNMENT**—Eastman Kodak Co., Rochester, N. Y. 23-page booklet describing the Kodak Axicon and its application to alignment problems. . .**59**

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For more details on products mentioned in July editorial or advertising pages, fill in below:

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COMPANY . . . . . . . . . . . . . . . . . . . . . . . . .

CO. ADDRESS . . . . . . . . . . . . . . . . . . . . . .

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For more details on products mentioned in July editorial or advertising pages, fill in below:

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CO. ADDRESS . . . . . . . . . . . . . . . . . . . . . .

CITY . . . . . . . . . . . . ZONE . . . . STATE . . . . . . .

This card is void after October 1, 1955 M-7/55

For more information on products advertised, use Inquiry Card, page 235

C. H. Kimmel, president of the Ohio Crankshaft Co.

OHIO CRANKSHAFT CO., Cleveland, Ohio, announces the following executive changes: C. H. KIMMEL has been made president. He joined the company in 1940 as factory manager of the Crankshaft and Camshaft Division; in 1953, he was made vice-president and general manager of the entire company. M. J. HOKE has been elected vice-president and general manager of the Crankshaft and Camshaft Division. He joined the company in 1945 as a development engineer. W. C. DUNN, co-founder and president of the company since its inception in 1920, has retired from routine business activities but continues his association with the firm as board chairman.

JOSEPH V. DELANEY has been elected vice-president of the Lodge & Shipley Co., Cincinnati, Ohio. He will also continue to serve as director of the company and general manager of the Hamilton Division, with which he has been associated since 1942.

Joseph V. Delaney, vice-president of Lodge & Shipley Co.

HOWARD C. LIEBING has been appointed sales manager of National Tool Co., Cleveland, Ohio. He has been with the company since 1941 and has previously served in the sales department and as production control manager for the past six years.

OHIO SEAMLESS TUBE DIVISION of Copperweld Steel Co., Shelby, Ohio, has named the following employes to important posts: J. E. HORNER, manager of sales; J. J. ARNTZ, assistant sales manager; and M. W. FREESE, promotion and market development manager.

JOHN C. COTNER has resigned as president and general manager of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. He continues as a director of the company.

## Pennsylvania

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., announces a number of executive changes which result in a major realignment of the company's sales division: C. B. BOYNE has been made director of customer service for the entire corporation; ROGER S. AHLBRANDT has been made executive assistant to the vice-president in charge of sales; F. PRICE NORRIS has been made director of stainless and specialty steel sales; and W. R. YINGST has been named coordinator of production control.

L. E. HEDRICK has been appointed Pacific Coast region manufacturing and repair manager for Westinghouse Electric Corporation, Pittsburgh, Pa. He will be located at the company's Sunnyvale, Calif. plant. Mr. Hedrick succeeds L. N. GOODELL who has been appointed manager of the Bryant Electric Co., Bridgeport, Conn., a wholly-owned subsidiary of Westinghouse.

BALDWIN-LIMA-HAMILTON CORPORATION, Philadelphia, Pa., announces the following executive appointments: MCCLURE KELLEY has been elected president, succeeding MARVIN W. SMITH; Mr. Smith as chairman of the committee, will continue as an executive officer of the company with special duties and responsibilities; ROBERT G. TABORS and ALBERT CLEMENTS have each been elected a vice-president of the Hamilton, Ohio, division.

AMERIGEAR-ZURN, INC., Erie, Pa., which markets flexible coupling and allied power transmission products manufactured by the American Flexible Coupling Co., Erie, Pa., has appointed CRYER & WOLFE, Swarthmore, Pa., as sales engineers. Their territory includes southwestern Pennsylvania, southern New Jersey, and Delaware.

WM. K. STAMETZ CO., Pittsburgh, Pa., announces the following executive appointments: W. J. SMETAK has been elected executive vice-president and treasurer of the company and its subsidiary; HENRY R. HANSON, vice-president of the company, was also made general sales manager of the Machine Tool Division.

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa., has begun construction of an iron foundry containing 48,000 square feet of floor space to replace the existing facilities which have been in operation since 1906. Production is expected to be shifted to the new building in October of this year without any interruption of schedules.

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh, Pa., announces the following appointments to new regional posts: In the Atlantic region, T. P. JONES has been named assistant manager with headquarters in Philadelphia, and ROBERT N. ANDERSON has been appointed electric utility manager; T. E. STIEBER named Philadelphia district manager.

ALEXANDER ZEITLIN has been elected vice-president of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. Mr. Zeitlin will continue to head as president the Engineering Supervision Co. of N. Y. which has been acquired by the Birdsboro firm.

S. L. CRAWSHAW has been appointed to the position of assistant to the president of the Philadelphia Gear Works, Inc., Philadelphia, Pa. He has had thirty years of technical and executive experience in the gear making industry.

S. L. Crawshaw, assistant to president, Philadelphia Gear Works, Inc.

LEEDS & NORTHRUP CO., Philadelphia, Pa., announces the following changes: EARLE D. MOILES, JR., has been promoted from sales field engineer to district manager of the Boston, Mass., office. He replaces PAUL K. WELCH, who becomes manager in New York. Mr. Welch succeeds HOWARD L. SCUTT, who was promoted to manager, Sales Engineering Division, Philadelphia, Pa.

R. E. ZAHN has been appointed manager of tool steel sales for the Dayton, Ohio district of Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Mr. Zahn joined the company in 1952 as a tool steel salesman.

MACHINERY DIVISION of STRUTHERS WELLS CORPORATION, Titusville, Pa., has announced the appointment of SHERIDAN-GRAY, INC., Torrance, Calif., as sales representative for the Western States.

TINIUS OLSEN II was elected president of the Tinius Olsen Testing Machine Co., Willow Grove, Pa. Mr. Olsen succeeds his father, Thorsten Y. Olsen, who has been elevated to chairman of the board.

L. W. GOLDEN has been named manager of the newly formed director systems department in Westinghouse Electric Corporation, Pa. Headquarters for the department will be located in the Pittsburgh area.

VAUX H. ADAMS has been made assistant district manager in the Detroit, Mich., district for Firth Sterling, Inc., Pittsburgh, Pa.

CLAUDE L. BORING has been appointed assistant to the president of Erie Foundry Co., Erie, Pa. He will carry many over-all management responsibilities.

Claude L. Boring, assistant to the president, Erie Foundry Co.

LEMUEL R. LANCE, INC., Philadelphia, Pa., has been appointed dealer in the Philadelphia area for the CINCINNATI GILBERT MACHINE TOOL CO., Cincinnati, Ohio.

WILLIAM D. HEAVNER, JR., has joined the research staff of the Stainless-Steel Research Section, Allegheney Ludlum Steel Corporation, Pittsburgh, Pa.

EDWARD B. COURTNEY has been appointed field engineer in the Metropolitan New York and Connecticut areas by Hunter Spring Co., Lansdale, Pa.

## Washington, D.C. and Maryland

ALBERT F. POLK, vice-chairman of the Sheffield Corporation, Dayton, Ohio, has accepted an invitation issued by the Business and Defense Services Administration, Washington, D. C., to serve for a limited time as chief of the facilities, distribution and inventory branch, Metal-Working Equipment Division. Mr. Polk will have his office in the Department of Commerce building.

Albert F. Polk, chief, facilities, distribution and inventory branch of Metal-Working Equipment Division of the BDSA

ADOLPH VLCEK, JR., has been named tooling manager at the GLENN L. MARTIN CO., Baltimore, Md., succeeding Glenn A. Evans, who has left the company. Mr. Vlcek joined the company in 1930. His last position was manager of quality control.

ARTHUR J. BUCKLEY has been promoted to sales manager of Pangborn Corporation, Hagerstown, Md., manufacturer of blast cleaning and dust control equipment. Mr. Buckley formerly served as assistant sales manager of the corporation.

Arthur J. Buckley, sales manager, Pangborn Corporation

## *Coming Events*

SEPTEMBER 6-17—Machine Tool Show sponsored by the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION to be held at the International Amphitheatre, Chicago, Ill. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17—PRODUCTION ENGINEERING SHOW, coinciding with the Machine Tool Show, to be held at the Navy Pier, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17—METALWORKING MACHINERY AND EQUIPMENT EXPOSITION to be held at the Coliseum, Chicago, Ill. Further information can be obtained from Chester L. Wells, general manager, 2689 East Overlook Road, Cleveland 6, Ohio.

OCTOBER 17-21—National Metal Exposition and Congress sponsored by the AMERICAN SOCIETY FOR METALS at the Convention Halls, Philadelphia, Pa. Further information from American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 23-26 — Semi-annual meeting, AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Edgewater Beach Hotel, Chicago, Ill.

NOVEMBER 14-18—Chicago Exposition of Power and Mechanical Engineering, under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, in conjunction with

## When you buy Socket Screws

# Look Beyond the Hex

Compare every detail of product and service. Compare for advanced design that speeds the job, and prevents errors — compare for proved assembly strength — for engineering information and buying aids. Get all the facts, and you'll find P-K Socket Screws take top rating in any test.

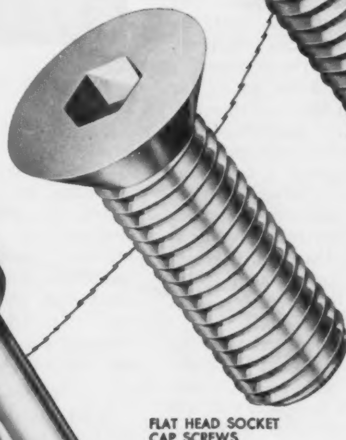
Get samples, information from your P-K Distributor, or write Parker-Kalon Division, General American Transportation Corporation, 202 Varick Street, New York 14.

IF IT'S P-K IT'S O.K.

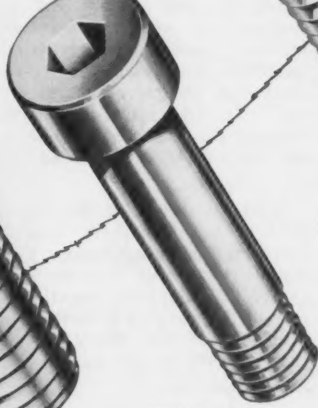
TRADE MARK REG. U.S. PAT. OFF.


SIZE-MARKED SOCKET HEAD CAP SCREWS

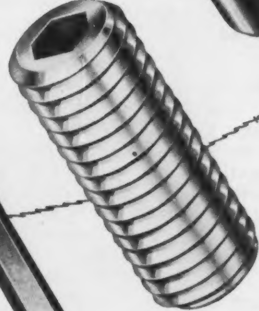
BUTTON HEAD SOCKET CAP SCREWS



FLAT HEAD SOCKET CAP SCREWS



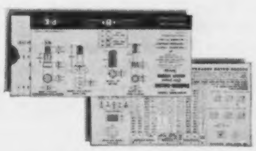
SHOULDER SCREWS



GROUND THREAD SOCKET SET SCREWS

ENGINEERED HEX KEYS

PIPE PLUGS



**SOCKET SCREW DIMENSION FINDER**
Helps you plan assemblies. Pocket-size plastic slide chart gives essential dimensions of all types of P-K Socket Screws. Call your **P-K SOCKET SCREW DISTRIBUTOR**

# PARKER-KALON® SOCKET SCREWS

*make planned assembly savings pay off*

For more information on products advertised, use Inquiry Card, page 235

their Seventy-fifth Anniversary Meeting, to be held in the Chicago Coliseum, Chicago, Ill. Further information can be obtained from the International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

# *New Books*

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1955). 9400 pages, 9 by 14 inches. Published by the Thomas Publishing Co., 465 Eighth Ave., New York 1, N. Y. Price, $15 f.o.b. shipping point.

More than 70,000 products, covering all lines of manufacture in the United States, are classified in the forty-fifth annual edition of this informative purchasing encyclopedia. The material is published in four volumes, in addition to the index to contents which facilitates convenient reference to the work.

The first three volumes list the names and addresses of manufacturers classified by products. The products are classified not only by generalized group names but by specific types, so that the prospective buyer can easily find the particular type that will meet his requirements. The names of the manufacturers under each product classification are arranged by states and cities, thus making it easy for a buyer to select a product within certain geographical boundaries if desired. All classifications are also thoroughly cross-indexed. A capacity or capital investment rating is given for each firm at each product listing.

The fourth volume contains an alphabetical list of manufacturers with branches, subsidiaries, and other data such as company officials and cable codes. It also gives an alphabetical list of trade names, together with export and other miscellaneous information that would be useful to the user.

Buyers, engineering research departments, production executives, and all those who require a list of products or names of manufacturers for volume purchasing purposes will find this "where to buy" source an invaluable aid.

PLASTICS TOOLING. By M. Riley. 123 pages, 4½ by 6¾ inches. Published by Reinhold Publishing Corporation, 430 Park Ave., New York 22, N. Y. Price, $2.50.

This is the latest in the Reinhold Series of Pilot Books. It presents, in essence, a report on the status of plastics tooling covering resins, their methods of use, and their major applications.

# *Obituaries*

## E. D. (Ed) Frank

E. D. (Ed) Frank, director and vice-president in charge of sales for the National Automatic Tool Co., Richmond, Ind., died suddenly on May 5 in Chicago where he had gone

E. D. (Ed) Frank

to attend the spring meeting of the National Machine Tool Builders' Association. Mr. Frank was sixty-nine years old, and was Natco's oldest employe in point of service. He worked first in the engineering department and later became superintendent, designer, and sales manager. In the latter capacity, he successfully promoted sales throughout this country and abroad.

WILLIAM JARMLEH KELLY, president of the Machinery and Allied Products Institute, Chicago, Ill., and senior partner of William Kelly & Co. of Chicago, died recently at the age of fifty-six. Mr. Kelly became president of the Machinery Institute in 1937 at the age of thirty-eight.

KURT R. VOGEL, secretary for Crucible Steel Company of America, Pittsburgh, Pa., died at his home in Pittsburgh on June 7 at the age of fifty-seven. Mr. Vogel was secretary for the company since 1940.

* * *

## Air Travel Soars

In 1954, the scheduled air lines of the United States, carrying an all-time record of 34,131,000 passengers, also established the best safety record in the history of air-line travel.

## Reviews of Available Motion Pictures

BULLARD SEVENTY-FIFTH ANNIVERSARY

Release of a new motion picture entitled "Yankee Toolmaker," has been announced by Bullard Co., Bridgeport, Conn., to commemorate the Seventy-Fifth Anniversary of the company. This 16-millimeter film, in sound and color, shows the growth of industry from colonial times to the present and the part machine tools have played in that growth. Arrangements can be made for showing the twenty-seven-minute motion picture by contacting the advertising department of the company.

INTEGRATED SHELL-MOLDING SYSTEM

A fifteen-minute color and sound motion picture on an integrated shell-molding system is now available from Link-Belt Co. It deals with a molding system that includes a four-station shell-molding machine and related conveying equipment to handle sand and resin, and a four-station shell-closing machine together with the conveying equipment for handling finished shells through pouring and shakeout stages. Typical examples of the castings made by this method are shown. This system, in production, has yielded up to 240 shells per hour. The film is available to interested groups by writing to the company, Department PR, 307 N. Michigan Ave., Chicago 1, Ill.

COPY-TURNING FILM AVAILABLE

A 16-millimeter color and sound film has been produced describing the New Britain copy-turning machine for contour copying shafts, bores, or face contours. The film shows an operator going through the various steps which make the lathes fast to set up. Animated drawings explain the compact copying slide and carriage, and show typical work applications. The film entitled "A New Approach to Copy Turning," may be borrowed from the New Britain Machine Co., New Britain-Gridley Machine Division, South and East Sts., New Britain, Conn.

PLANT MODERNIZATION

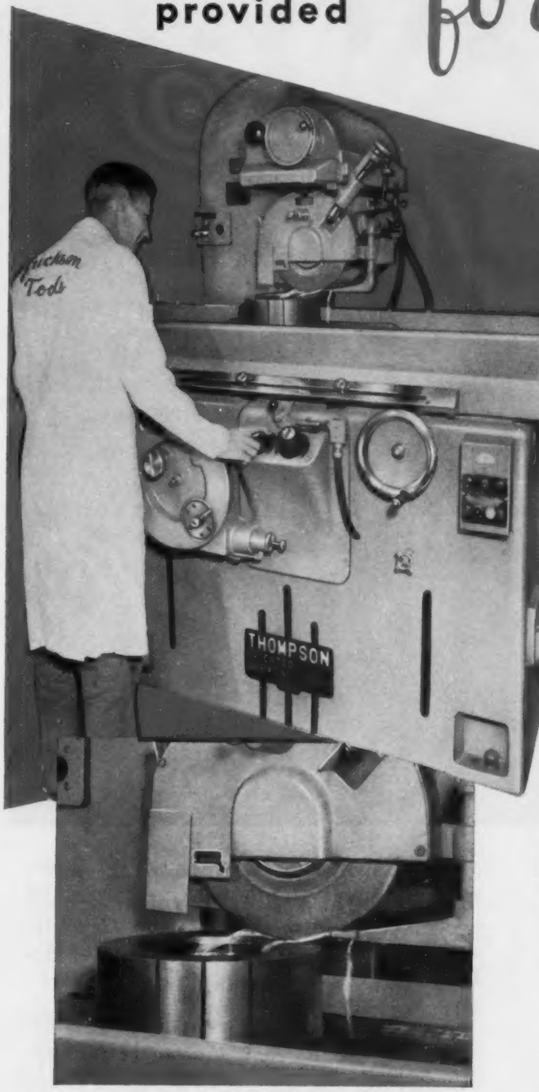
A 16-millimeter color and sound motion picture, "A Way of Thinking," is available on a free-loan basis from the Cincinnati Lathe & Tool Co., 3271 Disney St., Cincinnati, Ohio. This fifteen-minute film tells how to combat obsolescence in metal-working plants in order to maintain an adequate defense base and to sustain a competitive industry position.

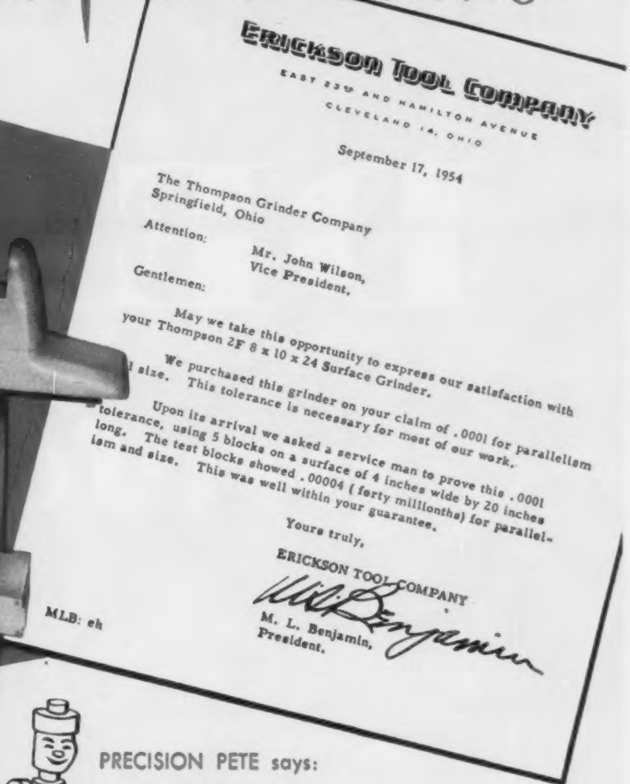
The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

# The Thompson 2F (8x10x24) Super Precision Grinder

## provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 23RD AND HAMILTON AVENUE
CLEVELAND 14, OHIO

September 17, 1954

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson, Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism size. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 ( forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

MLB: eh

PRECISION PETE says:

"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

*"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."*

- HARDENED AND GROUND cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- HARDENED AND GROUND sealed anti-friction vertical slide.
- HARDENED AND GROUND BED WAYS with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- GROUND THREAD FEED SCREW.
- Automatic wheel TRUING device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

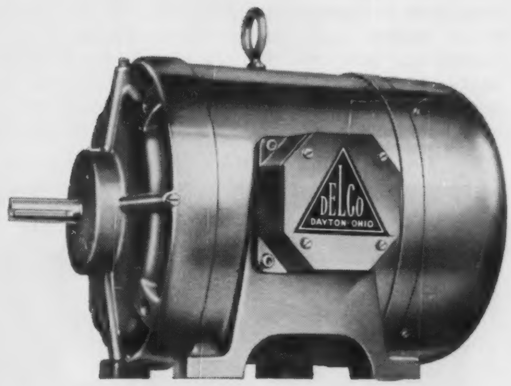
*Call, write or wire for estimate*

**Thompson Grinders**

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO


For more information on products advertised, use Inquiry Card, page 235

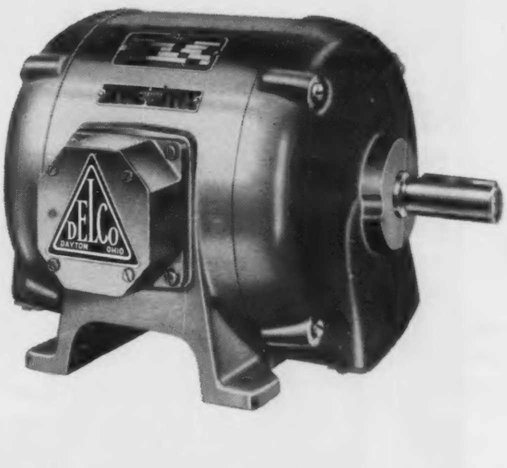
DELCO
DAYTON OHIO



With this quality control, Delco motors perform better, stand up longer, cost less to maintain.

That's why, for almost every industrial need and product application, you will find Delco preferred. And wherever Delco motors go to work, Delco parts and service aren't far away.

Your request for further information will receive a prompt reply.



GM GENERAL MOTORS

**DELCO *Electric* MOTORS**

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS, DAYTON, OHIO

*Proved best by Performance!*

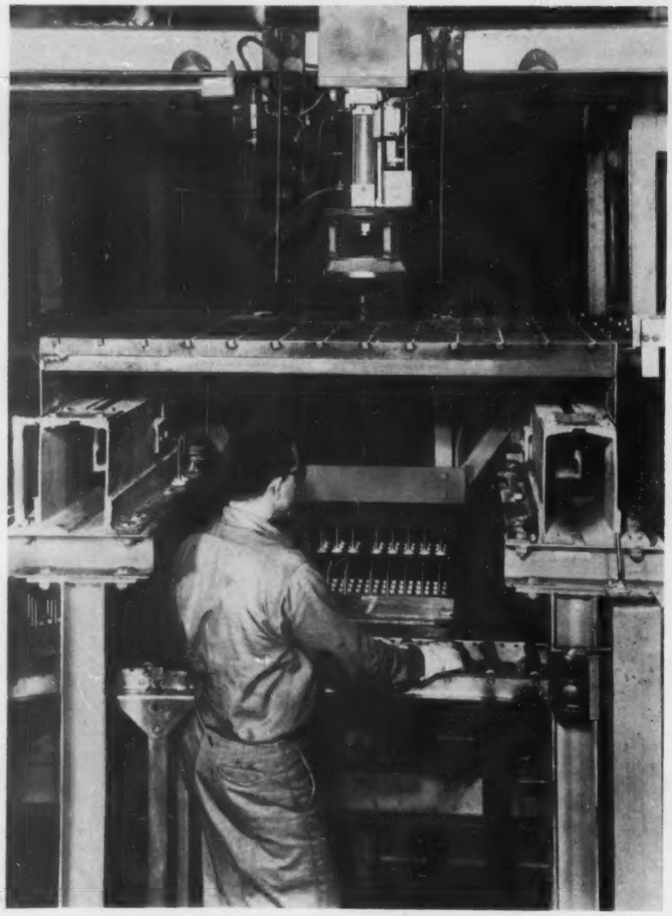
For more information on products advertised, use Inquiry Card, page 235

## Aluminizing of Automobile Engine Valves

Valves for automobile engines are now being aluminized at the Valve Division of Thompson Products, Inc., in Cleveland, Ohio, by a new process that has greatly reduced valve burning. Performance tests by a leading car manufacturer show that exhaust valve life has been increased from 200 to 500 per cent. The aluminizing line, developed jointly by engineers from Thompson Products, Inc., and Ajax Electric Co., Philadelphia, Pa., produces valve heads with an iron-aluminum alloy that has excellent resistance to high-temperature oxidation.

Termed the "Alspray" process, the facilities incorporate the following operations: preheating the valves, spraying aluminum on the heads, fluxing and bonding the aluminum by immersing the heads in a molten salt bath, water quenching, acid rinsing, and a final hot-water rinse. The original aluminum coating process used at Thompson was developed by General Motors Research Laboratories under the name of "Aldip." With this process, aluminum was applied to the valves by dipping them into the fluxing bath, followed by immersion in molten aluminum. It was found that processing costs could be appreciably reduced and production increased by applying aluminum to the valves before immersing them in the fluxing bath. Accordingly, the "Aldip" facilities at Thompson were converted to the new "Alspray" process (also of General Motors origin).

The "Alspray" line is almost completely automatic. All operations are mechanized except for unloading the valves from the spraying fixtures, and unloading the coated valves at the completion of the process. Valves are "Alsprayed" after the seats and stems have been finished. Preheating of the heads by gas torches is followed by a metallizing operation in which aluminum is sprayed on the heads. The sprayed valves are then automatically engaged in special fixtures, as seen in the illustration, which are automatically conveyed through the entire fluxing-cleaning cycle. A special Ajax electric salt-bath fluxing furnace is used, each valve being in the 1350-degree F. molten salt for approximately one minute.

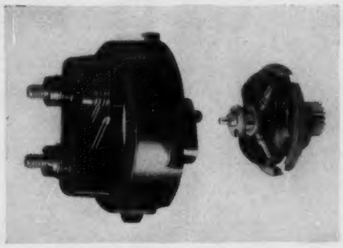


(Left) Sprayed valves are automatically engaged in fixtures, after which they are cycled through the salt bath fluxing furnace and the quenching and rinsing baths.

* * *

## Carboloy Ring Magnet in Motor Clock Solves Design and Production Problems

A small ring-shaped permanent magnet simplified manufacturing techniques of the Motochron automobile clock announced recently by the Clock and Timer Department of the General Electric Co., Schenectady, N. Y., and is said to have led to the development of the first direct-current clock motor used in conjunction with a permanent magnet. The Motochron clock is designed to use a continually operable torque motor.

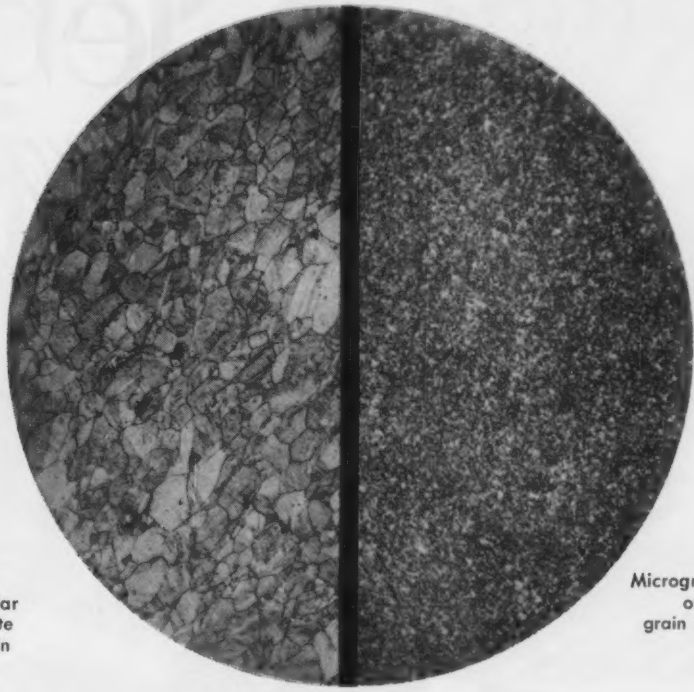


Carboloy ring-shaped permanent magnet molded into phenolic end cap, shown at left, provides bearing for the armature and supports the brushes, at right.

The stator consists of a Carboloy ring magnet molded into the phenolic end cap. The end cap provides an oil-less bearing for the armature, and supports the brushes. After the brushes are assembled to the end cap, the whole unit is magnetized, thereby assuring positive and permanent location of the magnetic axis of the stator with respect to the other components of the motor. The result is a motor of simplified design and manufacture.

# Get longer life in formed parts AT NO EXTRA COST

## USE THE NEW FINE GRAIN PHOSPHOR BRONZE WITH 30% GREATER ENDURANCE LIMIT



Micrograph (75x magnification) of regular phosphor bronze. Note relatively coarse grain structure.

Micrograph (75x magnification) of Duraflex. Its fine grain structure is the secret of its superiority.

# DURAFLEX*

BY ANACONDA

**DURAFLEX** is a new, fine-grain phosphor bronze developed and sold only by Anaconda. Comparative fatigue tests show that the endurance limit of DURAFLEX is approximately 30% higher than for regular phosphor bronzes. In surface appearance, surface smoothness and hardness, it is superior to other phosphor bronzes. It is unsurpassed in corrosion resistance by any other phosphor bronze. Further, its formability is increased with no sacrifice in yield strength. DURAFLEX is a *premium* phosphor bronze in every way except cost; there's *no increase in price*.

If you're now using a hard-temper phosphor bronze, chances are that you can do the same forming in extra-hard temper DURAFLEX.

If you're looking for longer life in the parts you form, we'll be glad to send you a free sample of DURAFLEX. Try it, test it, and you will agree that it is superior. 5581

*Trade Mark

SEE FOR YOURSELF—

AN ANACONDA® PRODUCT

MADE BY THE AMERICAN BRASS COMPANY

**FREE SAMPLE**

**The American Brass Company, Waterbury 20, Conn.**

(In Canada: Anaconda American Brass Ltd., New Toronto, Ontario)

Yes, we'd like to try DURAFLEX. Please send us a free sample of

sheet in__________temper,__________thick,

wire in__________temper,__________diameter.

☐ We'd like to talk to one of your representatives about DURAFLEX.

NAME. . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

COMPANY. . . . . . . . . . . . . . . . . . . . . . . . . . . .

STREET. . . . . . . . . . . . . . . . . . . . . . . . . . . . .

CITY. . . . . . . . . . . . . . . . . STATE. . . . . . . . . . . .

SHEET . . . up to 0.062" thick

WIRE . . . up to 3/16" diameter (approx.)

For more information on products advertised, use Inquiry Card, page 235

Nebel
LATHES
CINCINNATI


**As an engine lathe.** *With the blocks in place on the bed, you're set to turn all standard engine lathe work. Blocks are easily removed, presenting a wide, deep gap.*

# Nebel gap lathes give your assorted turning jobs the ole 1-2

Nebel removable block gap lathes give you (1) standard engine lathe turning plus the bonus of (2) extra swing capacity. The 16″/27″ model, for example, gives you 9″ extra swing within a 15″ wide gap. 48% more capacity! Yet it costs only a few dollars more than the average engine lathe!

With this bonus capacity, the Nebel gap lathe frequently does the work of two engine lathes, yet occupies the floor space of just one machine. Why buy less, when Nebel's your best buy? Sizes 16″/27″, 20″/30″ and 25″/40″. The Nebel Machine Tool Co., Cincinnati 25, Ohio, U.S.A.

THE MACHINE TOOL SHOW
CHICAGO, ILL.

*See the new Nebel lathes in action at the Machine Tool Show in Nebel booth 511.*

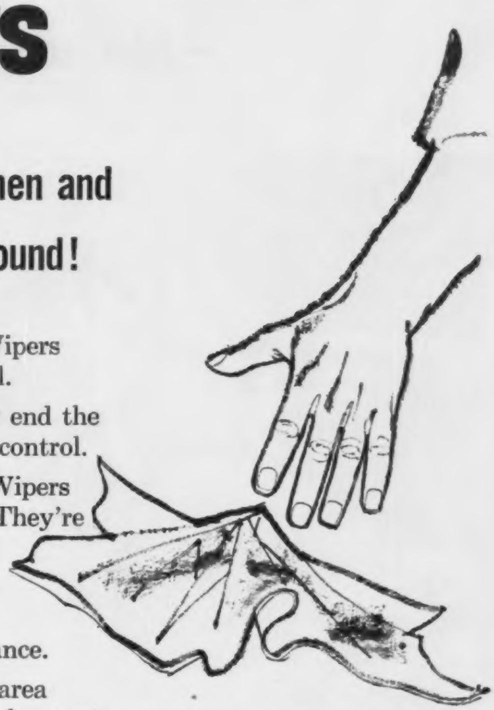

**As a gap lathe.** *With the blocks removed, the Nebel gap lathe can accommodate big, odd-shaped jobs that would normally require a larger lathe.*

For more information on products advertised, use Inquiry Card, page 235

# Your wiping problems increase in hot weather...

# *another reason for switching to* **Scott Wipers**

## This remarkable new product protects men and metal . . . steps up efficiency all year around!



Because a fresh one is always available—Scott Wipers provide a constant source of clean wiping material.

Scott Wipers are sanitary and disposable. They end the laundering problem . . . simplify distribution and control.

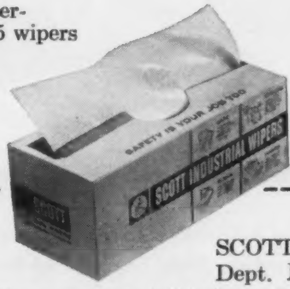
Throughout the metalworking industry, Scott Wipers are providing ready answers to wiping problems. They're two-ply and tough—yet soft and absorbent. And they stay tough even when soaked in solvents.

Compare them with whatever wiping material you're using now—for cost, convenience, performance.

The Scott representative or distributor in your area stands ready to help you set up a production line demonstration in your plant. Call him or mail this coupon today.

***And, best of all, Scott Wipers are* DISPOSABLE!**


**DISTRIBUTION** ***is simple . . .*** The Dispenser-box is a portable supply of 125 wipers




SCOTT PAPER COMPANY
Dept. M-B, Chester, Pa.
Please send me full information on Scott Industrial Wipers.

Name________________________________

Company______________________________

Address______________________________

City________________State____________

For more information on products advertised, use Inquiry Card, page 235

# *Seven years service for*
# STANOIL *Industrial Oil*
# *at David Bradley Mfg. Works*
# *—No down time for lubrication*

L. R. Cummings (left), Standard lubrication specialist, inspects sample of STANOIL, with Robert C. Menken, Plant Engineer of David Bradley Manufacturing Works. Larry Cummings has been serving industrial customers for Standard Oil since graduation from Standard's Sales Engineering School. His mechanical engineering degree from Tri-State College of Indiana qualified him for this work. Customers of Larry's find this experience and background pay off for them.

**David Bradley Tri-Trac, handy piece of farm equipment, gives farmer new opportunity for mechanization at low cost. Upper frame on which gasoline tank is mounted, is part formed in HPM press.**

Seven years ago, David Bradley Mfg. Works installed 900 gallons of Stanoil Industrial Oil in an HPM press. There's been no down time required for lubrication maintenance since. A pump by-pass screen filter is the only filtering the oil receives, yet the system continues clean. In March, 1954, an analysis of the oil showed:

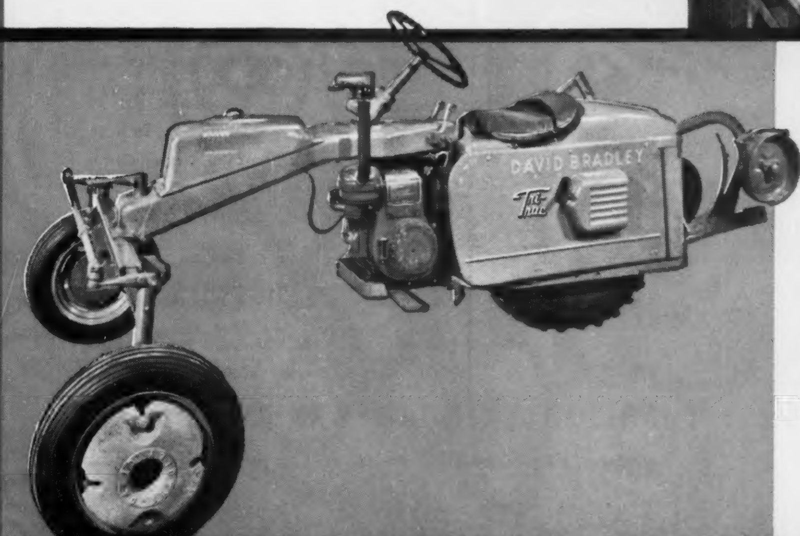
**Viscosity @ 100°F.—980**
**Color, NPA — 6**
**Neutralization No.— .11**

Stanoil Industrial Oil has long been at work for Bradley. Successful operations with it in other equipment caused Bradley engineers to specify Stanoil for this installation.

The HPM double acting, fast traverse hydraulic press reported on here is used to draw the upper frames for the David Bradley Tri-Trac, compact farm tractor. The Tri-Trac is the newest implement in the Bradley line. Bradley has been making farm implements since 1832.

Like to know more about Stanoil? Perhaps it can serve you as efficiently as it is serving David Bradley. Lubrication specialists in any Standard Oil office will be happy to help. In the midwest, a call to one of them will bring a prompt response. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.


**HPM 500-ton press on the upstroke after drawing upper frame for David Bradley Tri-Trac. Hydraulic system remains clean after 7 years service using STANOIL.**




STANDARD

**STANDARD OIL COMPANY**
(Indiana)

# Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

**ABRASIVE CLOTH, Paper and Belt**

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

**ABRASIVES**

See Discs, Abrasive

**ABRASIVES, HONING**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

**ABRASIVES, Polishing, Tumbling, Etc.**

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

**ACCUMULATORS, Hydraulic**

American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St. Ansonia, Conn.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

**AIR HOISTS**—See Hoists, Air.

**AIR TOOLS**—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

**ALLOY STEELS**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

**ALLOY STEELS, High Temperature**

Firth Sterling Inc., 3113 Forbes St., Pittsburgh

**ALLOYS, Non-Ferrous**

American Brass Co., 25 Broadway, New York
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

**ALLOYS, Zinc**

New Jersey Zinc Co., 160 Front St., New York, N. Y.

**ARBOR PRESSES**

See Presses, Arbor

**ARBORS AND MANDRELS**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(Continued on page 258)

PREVIEW ITS SPEED, ACCURACY AND VERSATILITY AT THE SHOW!

**CAST IRON END PLATES**
30 pieces (60 surfaces) per hour; 1/8" stock removed each side; limits ± .002"

**ADJUSTING SCREW WASHERS**
Low carbon steel; 200 pieces (200 surfaces) per hour; .025" stock removed; limits ± .001"

**HOT ROLLED STEEL CAMS**
225 pieces (450 surfaces) per hour; 1/32" stock removed each side; limits ± .001"

# NOW! BLANCHARD PRESENTS ANOTHER GREAT NEW GRINDER

## *with Automatic Cycle Control*

When you're at the show, watch this great new Blanchard Surface Grinder perform a variety of jobs with speed, ease and accuracy.

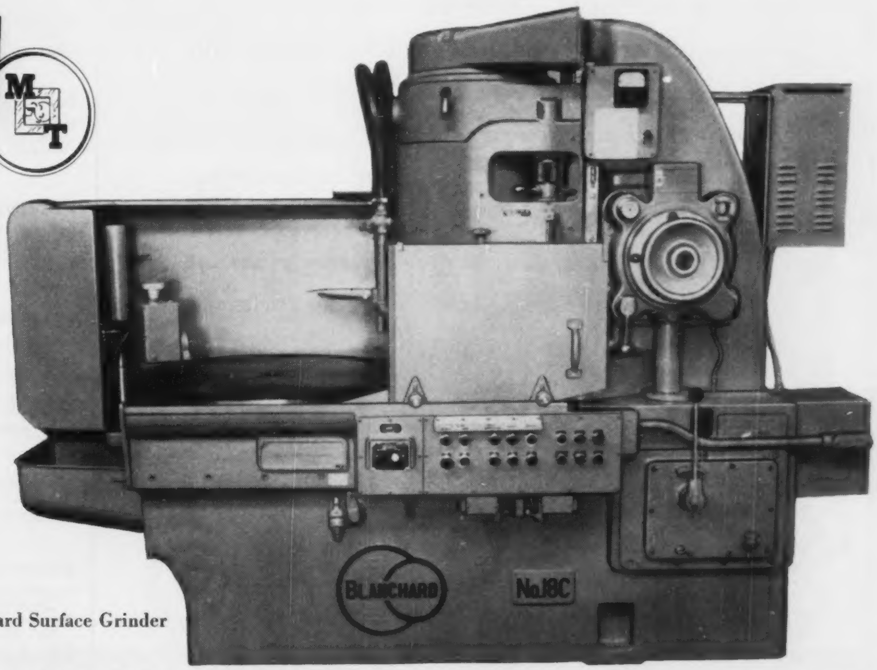
One operator can easily operate two of these No. 18-C grinders under balanced conditions. By using the automatic cycle, he can unload, clean and reload one grinder while the other is grinding.

Here's what the automatic cycle does: moves chuck (30" or 36" dia.) to grinding position and starts it rotating; starts wheel rotation and coolant pump; provides rapid wheel approach to work; engages power down-feed at preset rate; changes to fine feed just before finished size is reached; stops feed when work is to size – "sparks" out; raises wheel head; stops wheel, coolant pump and chuck; moves chuck to loading position – demagnetizes chuck.

This new Blanchard also features: push button selection of manual or cycle operation; size control; simplified feed and head traverse controls; adjustable dwell timer.

THE MACHINE TOOL SHOW
CHICAGO, ILL.

BOOTH 406




No. 18-C Blanchard Surface Grinder

**THE BLANCHARD MACHINE COMPANY** 64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

**BABBITT**

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

**BALANCING EQUIPMENT**

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**BALL BEARING TESTERS**

Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

**BALLS**

Kennametal, Inc., Latrobe, Pa.

**BARS, Phosphor Bronze**

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

**BARS, Steel**

Allegheney Ludlum Steel Corp., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

**BASES, Machinery Welded**

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

**BEARINGS, Babbitt**

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.

**BEARINGS, Ball**

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

**BEARINGS, Bronze and Special Alloy**

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

*(Continued on page 260)*

ONE OF A SERIES

# You Get Many Benefits By Specifying VICKERS® Hydraulics

# *Reduced Maintenance Costs*

Vickers Oil Hydraulic Equipment is built to minimize maintenance . . . has an outstanding performance record. Nevertheless, Vickers recognizes that sooner or later any piece of machinery requires overhaul. So we have developed a service department of exceptional efficiency . . . one that is convenient for you by reason of full time factory-trained service men working out of our offices from coast to coast.

Shown below are several of the practical aids provided to assure you quick and economical service on Vickers Hydraulics.

**VICKERS Incorporated**
*DIVISION OF THE SPERRY CORPORATION*
1403 OAKMAN BLVD. • DETROIT 32, MICH.

*Application Engineering Offices:* • ATLANTA CHICAGO AREA (Brookfield) • CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) • PHILADELPHIA AREA (Media) PITTSBURGH AREA (Mt. Lebanon) • ROCHESTER ROCKFORD • SAN FRANCISCO AREA (Berkeley) SEATTLE • ST. LOUIS • TULSA • WASHINGTON WORCESTER

### SPARE PARTS RECOMMENDATIONS

Our service men will study your situation and make practical recommendations on your spare parts inventory . . . will check your inventory and provide you with printed lists of parts usually required.


### SERVICE KITS

Packaged repair kits for many Vickers products are available. These provide all needed parts for quick repair in the field and at minimum cost. In addition, these kits simplify stock problems by reducing the number of loose parts.

### PREVENTIVE MAINTENANCE

Our service men will gladly set up for you an effective program of preventive maintenance on a timetable basis. This avoids costly down time and keeps maintenance costs at a minimum.

### SERVICE SCHOOL

Vickers maintains a Hydraulics Training School for engineering, maintenance and service personnel of both original equipment manufacturers and their customers. For further information, please contact Product Service Department directly.

7143

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

**BEARINGS, Lineshaft**

Fafnir Bearing Co., New Britain, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

**BEARINGS, Needle**

Orange Roller Bearing Co., Inc., Orange, N. J.

**BEARINGS, Roller**

Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

**BEARINGS, Self Lubricating (Oilness)**

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.

**BEARINGS, Tapered Roller**

Timken Roller Bearing Co., Canton, Ohio.

**BEARINGS, Thrust**

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

**BELT SHIFTERS**

Standard Pressed Steel Co., Jenkintown, Pa.

**BELTING, Transmission**

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

**BENCHES, Work, and Bench Legs**

Standard Pressed Steel Co., Jenkintown, Pa.

**BENDING MACHINES, Angle Iron, Plate, Etc.**

Consolidated Mch. Tool Corp., 656 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

*(Continued on page 262)*



For more information on products advertised, use Inquiry Card, page 235

# THE Delpark TOUCH

## Assures Clean Coolant in

## ALCOA'S Die Shop

**(LAFAYETTE, INDIANA)**

Alcoa's dies for extruding aluminum must have precision and flawless machine work. To insure precision in facing their extrusion dies, Alcoa's die shop at Lafayette, Indiana, makes use of DELPARK filtration on a Blanchard grinder to remove grindings from the coolant.

DELPARK offers you many advantages through coolant filtration. Greater accuracy and quality, longer tool life, increased machine efficiency and reduced maintenance costs often result in yearly savings which are greater than the original filter cost.

Let a field engineer show you how DELPARK filtration can increase savings for you. *Write today for more information.*

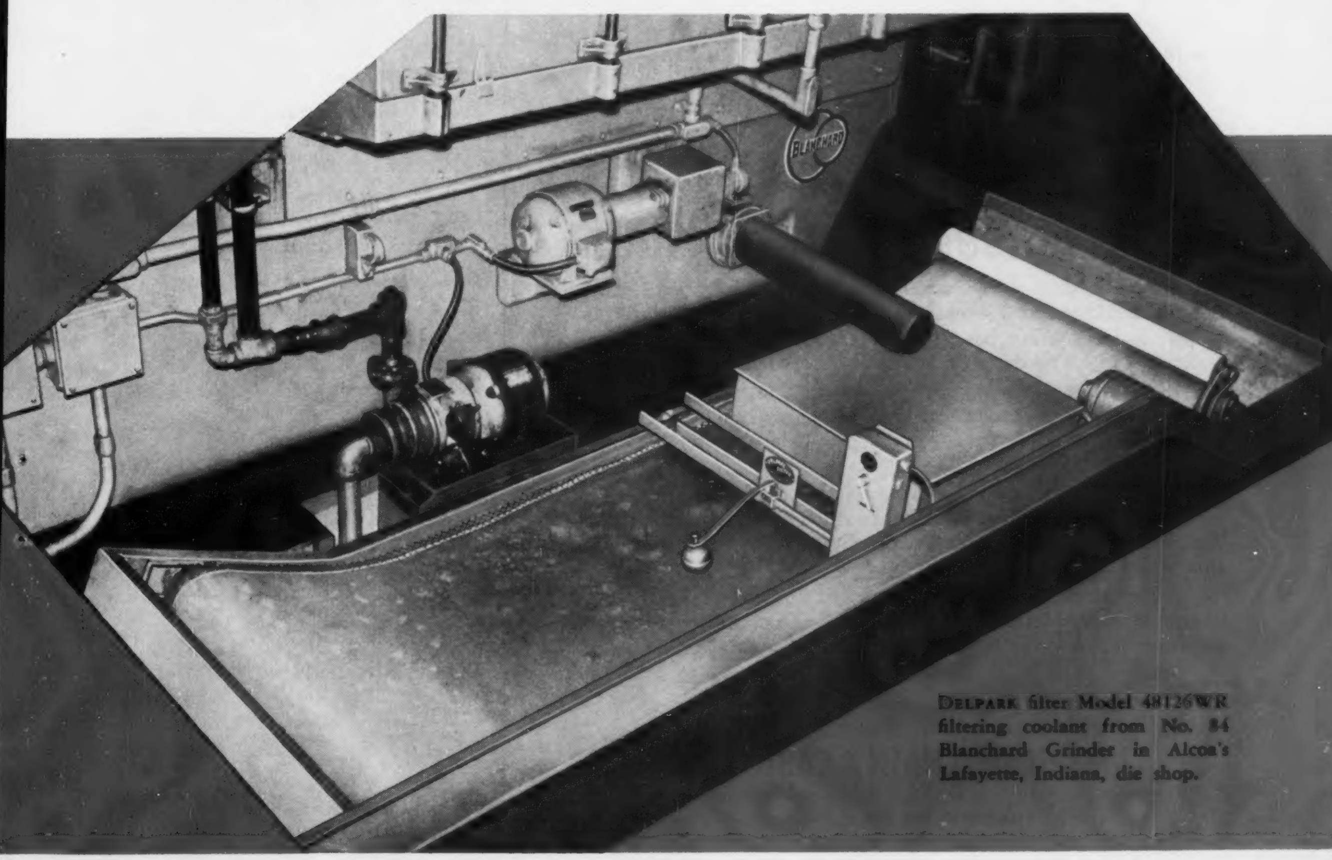
**Backed by more than 40 years experience in Industrial Filtration**

*Free*


**ON REQUEST!**

If your grinders are using unfiltered coolant, you're wasting money. DELPARK'S bulletin on coolant filtration can help you increase production and machine efficiency.

IT'S FREE ... *write today for your copy.*



DELPARK filter Model 48126WR filtering coolant from No. 84 Blanchard Grinder in Alcoa's Lafayette, Indiana, die shop.

**INDUSTRIAL FILTRATION COMPANY, 15 INDUSTRIAL AVENUE, LEBANON, INDIANA**

**BENDING MACHINES, Hydraulic**

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

**BENDING MACHINES, Pipe**

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.

**BLAST CLEANING EQUIPMENT**

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagestown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

**BLOWERS**

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**BLUING LAYOUT**

Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

**BOILER TUBES**

Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Joseph T., & Son. Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

**BOLT AND NUT MACHINERY**

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

**BOLTS AND NUTS**

Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

**BOOKS, Technical**

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

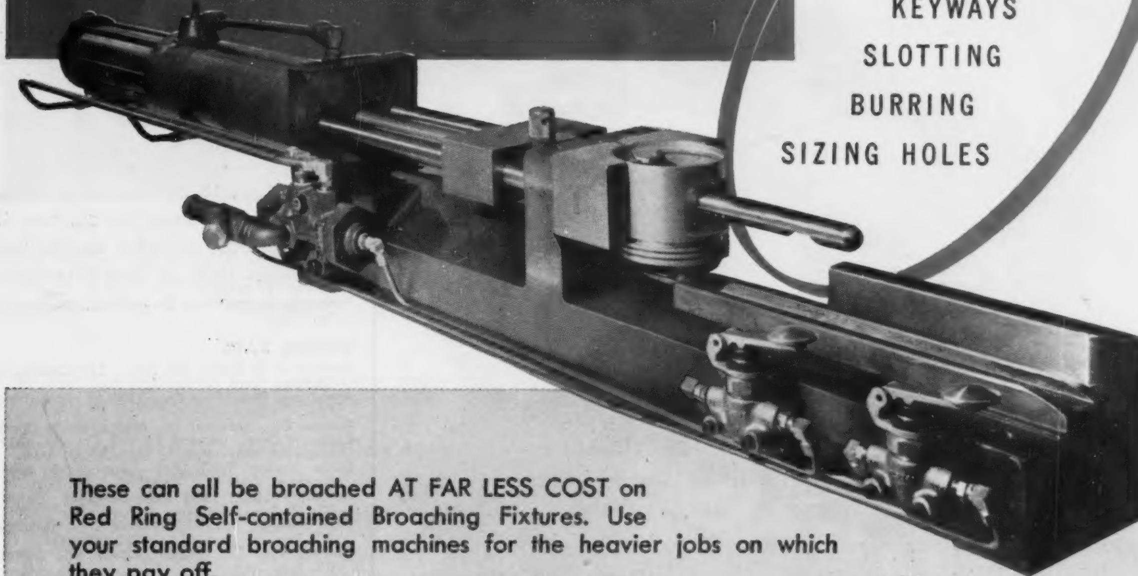
**BORING AND DRILLING MACHINES**

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.

*(Continued on page 264)*

# Don't Let *Small Parts* Clutter Up Your BROACHING OPERATIONS

OIL GROOVES
SMALL SPLINES
SERRATIONS
KEYWAYS
SLOTTING
BURRING
SIZING HOLES



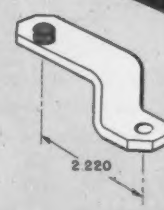
These can all be broached AT FAR LESS COST on Red Ring Self-contained Broaching Fixtures. Use your standard broaching machines for the heavier jobs on which they pay off.

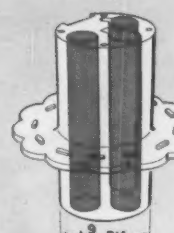
The Self-contained Fixture has its own pneumatic power unit to pull or push the broach. Just set it on a table, connect it to the air line and you are ready to start broaching. Or you may want to mount it vertically to further economize floor space.

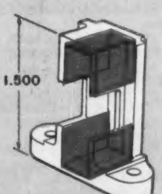
Like other fixtures or dies, these units may be stored in the tool room when not in use. They occupy little space and are easily portable.

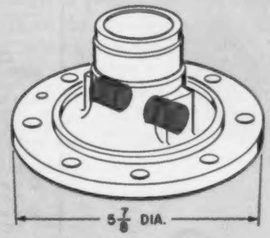
Application is practically unlimited for jobs requiring a "Pull" of 2,000 lbs. or less and a stroke not exceeding 25 inches.

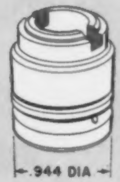
Call a Red Ring Broach Engineer or write for Bulletin B54-9 for more detailed information.

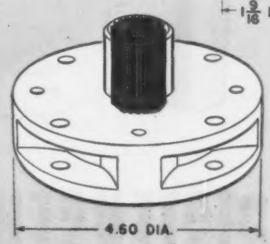


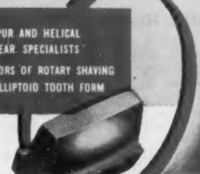



SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

**NATIONAL BROACH & MACHINE CO.**

5600 ST. JEAN . . . . . . . . . . . . . . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

7018

Bullard Co., Brewster St., Bridgeport 2, Conn.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.

**BORING AND TURNING MILLS, Vertical**

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

**BORING BARS**

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carbolay Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**BORING, DRILLING AND MILLING MACHINES, Horizontal**

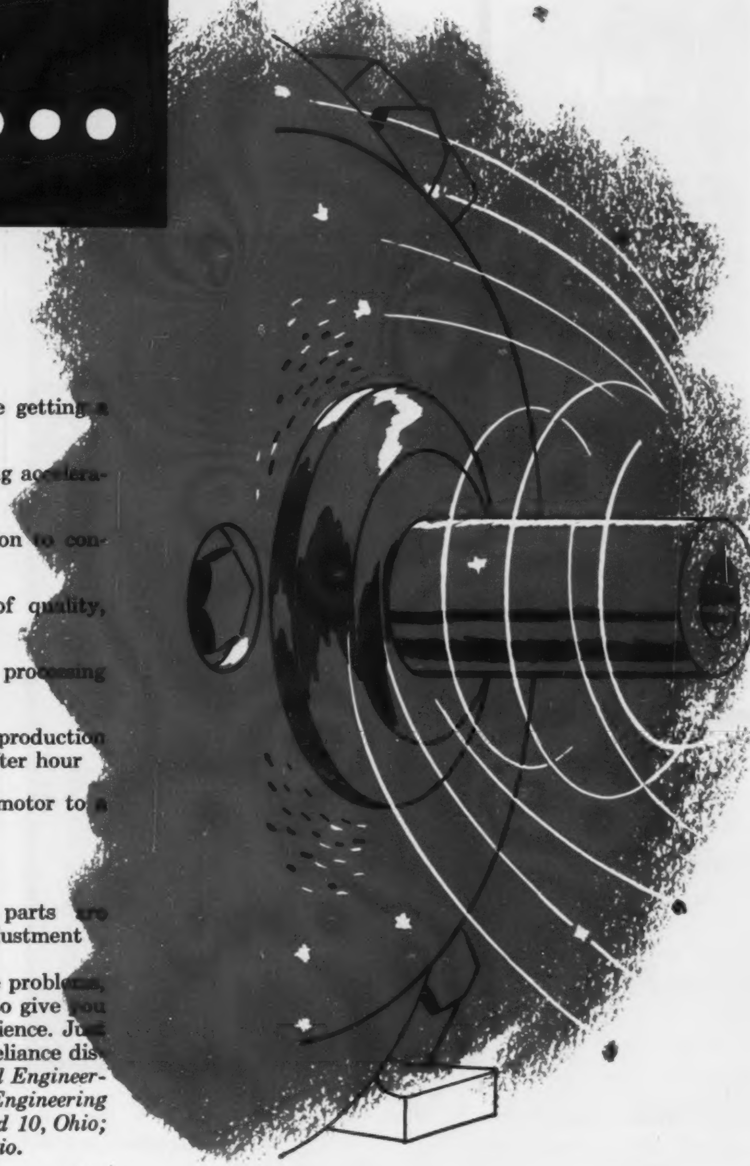
(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Portage Machine Co., 1069 Sweitzer Ave., Akron 11, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

**BORING HEADS**

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

*(Continued on page 266)*



Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**BORING MACHINES**

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

**BORING MACHINES, Jig**

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cee Mfg. Co., 21-25 44th Ave., L.I. C., N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Mis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

**BORING TOOLS**

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth-Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York., N. Y.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**BRAKES, Press and Bending**

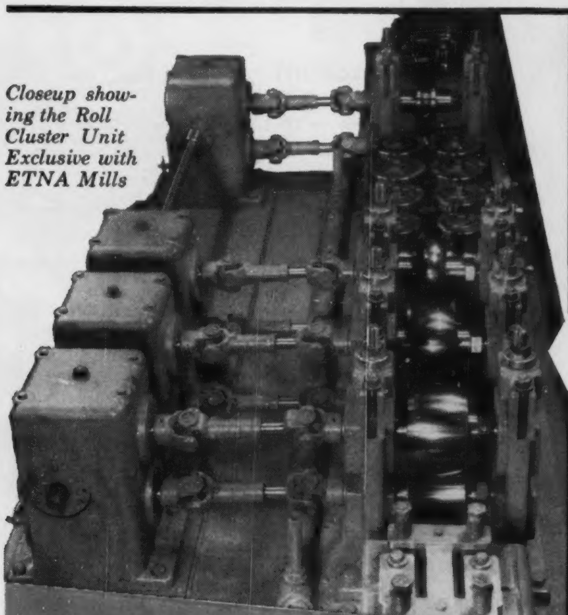
Bliss, E. W., Co., 1375 Raff Road, S. W. Canton, Ohio.
Cincinnati Shaper Co. Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

(*Continued on page* 268)

## LEADING THE INDUSTRY IN DESIGN...

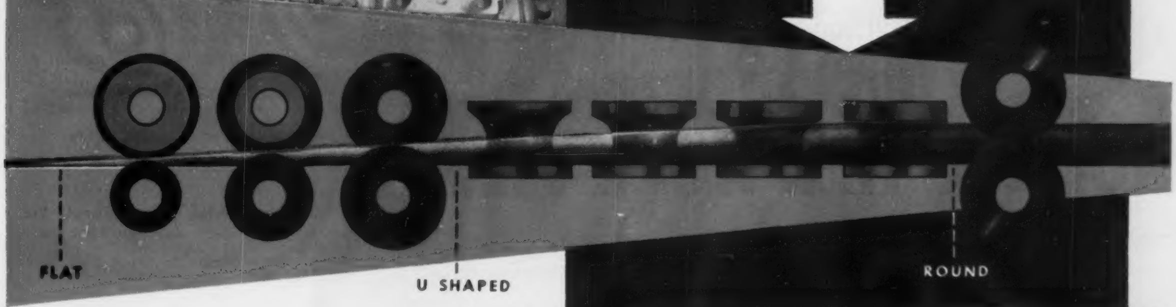
**NO MARKING . . . NO SCRATCHING**
**NO UPSET EDGES . . .**

*Closeup showing the Roll Cluster Unit Exclusive with ETNA Mills*



# THE *Etna* METHOD

## FOR SMOOTH, WELL FORMED STEEL TUBING




Exclusive with Etna is the cluster unit. This unit progressively rolls the tube into shape without excessive stretching of the edges, thereby eliminating the "buckling" experienced with ordinary tube mills. Etna machines are not forming mills, they are designed for one purpose only . . . to make clear, well formed carbon and stainless steel tubing with no marking, no scratching, no upset edges. Write for complete details.

*The ETNA 4KU Mill*

# *Abbey* ETNA *Company*

**3422 MAPLEWOOD AVE., TOLEDO 10, OHIO**

For more information on products advertised, use Inquiry Card, page 235

Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

**BROACHES**

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Detroit Broach Co., Detroit, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shearcut Tool Co., Reseda, Cal.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**BROACHING MACHINES**

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Forte-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**BRONZE**

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

**BRUSHES, Industrial, Wire Wheel, Etc.**

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

**BUFFERS**

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

**BULLDOZERS**

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

**BURS**

See Files and Burs, Rotary

**BUSHINGS, Brass, Bronze, Carbide, Etc.**

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.

(*Continued on page 270*)



For more information on products advertised, use Inquiry Card, page 235

### BUSHINGS, Hardened

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1925 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

### BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

### CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

### CALIPERS

Ames, B. C., & Co. (Dial) Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starret, The L. S,. Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2351 11th St., Rockford, Ill.

### CAM MILLING AND GRINDING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

### CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Machry. Co. 287 Homestead St., Hartford, Conn.
Rowbotton Machine Co., Waterbury, Conn.

### CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

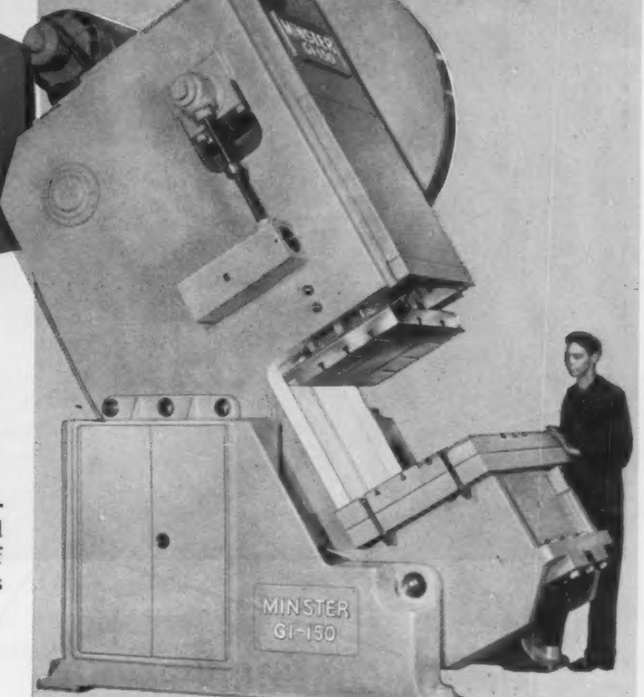
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jarvis Corp., Middletown, Conn.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Valenite Metals Corp., Box 205, Royal Oak, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernon Hwy., Detroit 1, Mich.

### CASEHARDENING FURNACES

See Furnaces, Heat-Treating
(*Continued on page* 272)

*Minster announces a completely New*

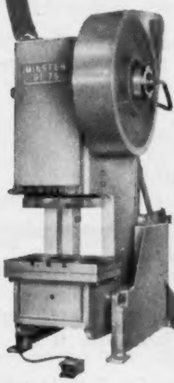
# STEEL FRAME GAP PRESS




## SERIES G1 PRESSES

*Patents Pending*

Today's most rigid and efficient gap presses—G1 Steel Frames, are engineered and fabricated with a completely new approach to the problem of achieving minimum deflection in steel "C" frames for gap presses.



CAPACITIES OF
75, 110, 150 and 200 Tons

- Fixed Base or Inclinable
- Flywheel or Geared Types
- Minster Patented Combination Air Friction Clutch and Brake
- Barrel Slide Adjustment and extremely long Slide Ways
- Power Inclining

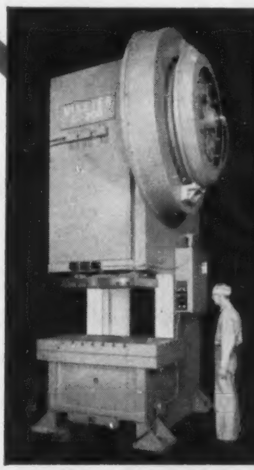
▲
Series G1-75 flywheel type inclinable gap press with manual inclining and standard leg.

MINSTER G1-150 ton geared type gap press—Motorized Inclining—Cabinet Legs house all electrical and air controls—Connect Air Line and Plug in power; in seconds, it's ready to operate.

**CONDENSED STANDARD SPECIFICATIONS**

| CAPACITY | STD. STROKE of slide | STROKES per minute | BED AREA | SLIDE AREA |
|---|---|---|---|---|
| 75 tons | 4 | Flywheel 90 or 120 Geared 40 | 24 x 36 | 18 x 24 |
| 110 tons | 5 | Flywheel 80 or 105 Geared 37 | 27 x 42 | 21 x 28 |
| 150 tons | 6 | Flywheel 80 or 105 Geared 30 | 30 x 50 | 24 x 34 |
| 200 tons | 8 | Geared 28 | 34 x 58 | 28 x 36 |

The 200 ton G1 fixed base geared type gap press—Available with either bed attached or sliding type die cushion. ▶



*Build a sound replacement program modernize with Minster Presses*

# MINSTER®

PRESSES

THE MINSTER MACHINE COMPANY, MINSTER, OHIO

For more information on products advertised, use Inquiry Card, page 235

**CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.**

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

**CASTINGS, Die**

American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

**CASTINGS, Iron**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

**CASTINGS, Steel, Alloys, Etc.**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

**CEMENT, Disc Grinding Wheel**

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

**CENTERING MACHINES**

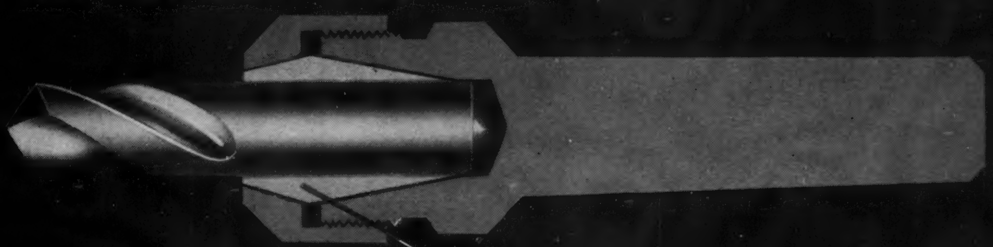
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

**CENTERS, Lathe**

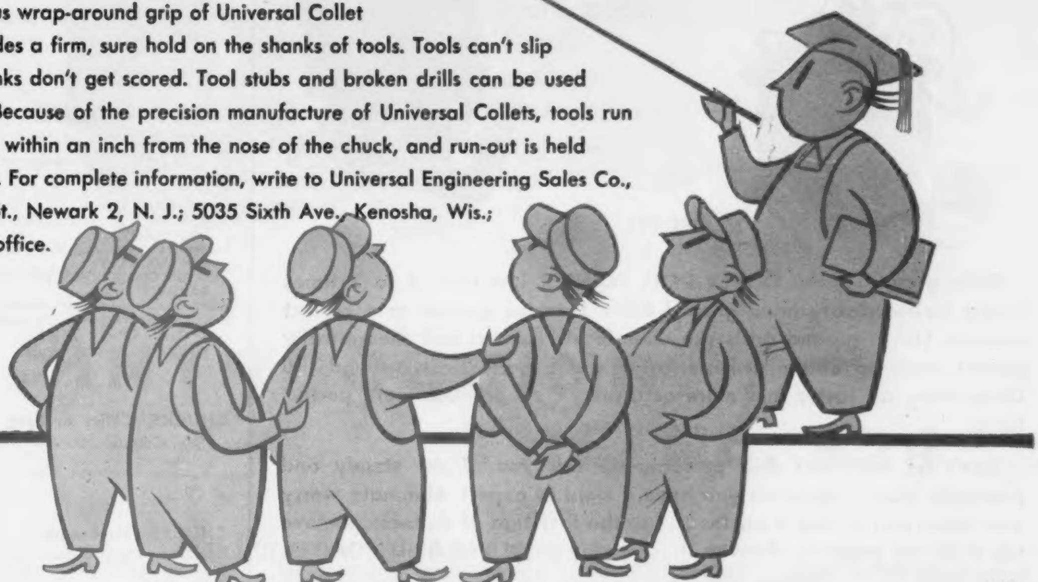
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

(*Continued on page 274*)

# SIMPLIFIED DESIGN OF UNIVERSAL COLLET CHUCKS PROVIDE A SURER GRIP FOR LONGER TOOL LIFE



The continuous wrap-around grip of Universal Collet Chucks provides a firm, sure hold on the shanks of tools. Tools can't slip and tool shanks don't get scored. Tool stubs and broken drills can be used successfully. Because of the precision manufacture of Universal Collets, tools run true to .001", within an inch from the nose of the chuck, and run-out is held to a minimum. For complete information, write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.



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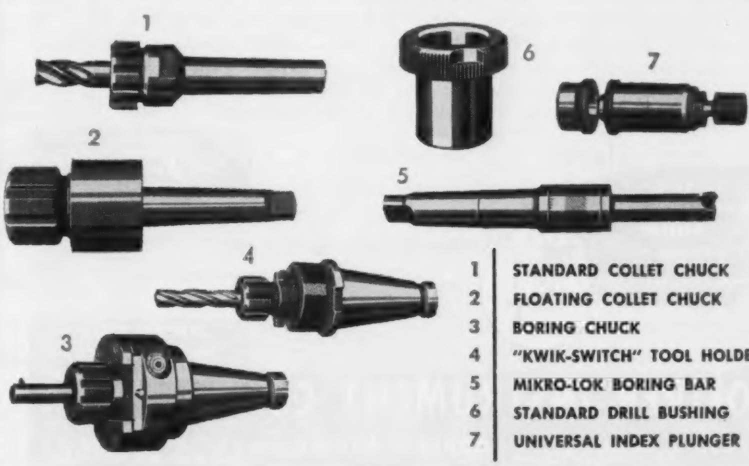
**UNIVERSAL ENGINEERING COMPANY**

FRANKENMUTH 2
MICHIGAN




1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

For more information on products advertised, use Inquiry Card, page 235

**CHAINS, Power Transmission and Conveyor**

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

**CHISELS AND CHISEL BLANKS**

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

**CHUCKING MACHINES**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

**CHUCKS, Air Operated**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**CHUCKS, Collet or Split**

See Collets

**CHUCKS, Diaphragm**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

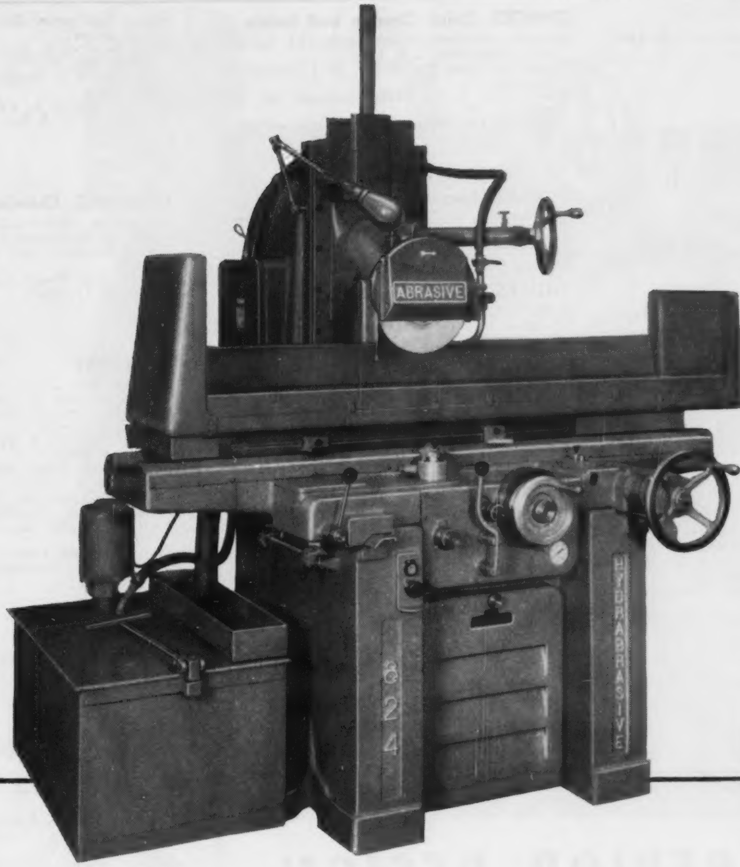
**CHUCKS, Drill**

Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Orban Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

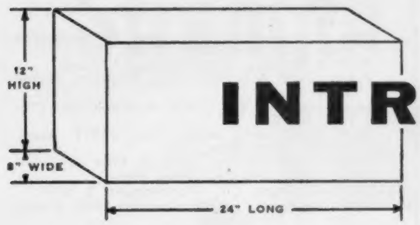
**CHUCKS, Full Floating**

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

*(Continued on page 276)*



THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE




# INTRODUCING...
# THE No. 824

Hydrabrasive super-performance now available in 8″ x 24″ capacity—for surface grinding jobs requiring long table length and moderate cross travel.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

**ABRASIVE MACHINE TOOL CO.**
**12 Dunellen Road East Providence 14, R. I.**

*Send for facts and figures!*

Send complete details on the new Hydrabrasive No. 824 Surface Grinder.

*Name*..........
*Company*..........
*Address*..........
..........
..........

**CHUCKS, Gear**

Gleason Works, 1000 University Ave., Rochester, N. Y.

**CHUCKS, Lathes, etc.**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**CHUCKS, Magnetic**

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

**CHUCKS, Power Operated**

Skinner Chuck Co., 344 Church St., New Britain, Conn.

**CHUCKS, Quick Change and Safety**

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

**CHUCKS, Ring Wheel**

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

**CHUCKS, Tapping**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Jarvis Corp., Middletown, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

**CIRCUIT-BREAKERS**

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**CLAMPS**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.





Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Precision Tool & Mfg. Co., 1305 S. Laramie, Cicero 50, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**CLEANERS, Chemical, for Metal**

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

**CLUTCHES**

Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

**COLLARS, Safety**

Standard Pressed Steel Co., Jenkintown, Pa.

**COLLETS**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Bridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**COMPARATORS**

See Gages, Comparator.

**COMPARATORS, Optical**

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

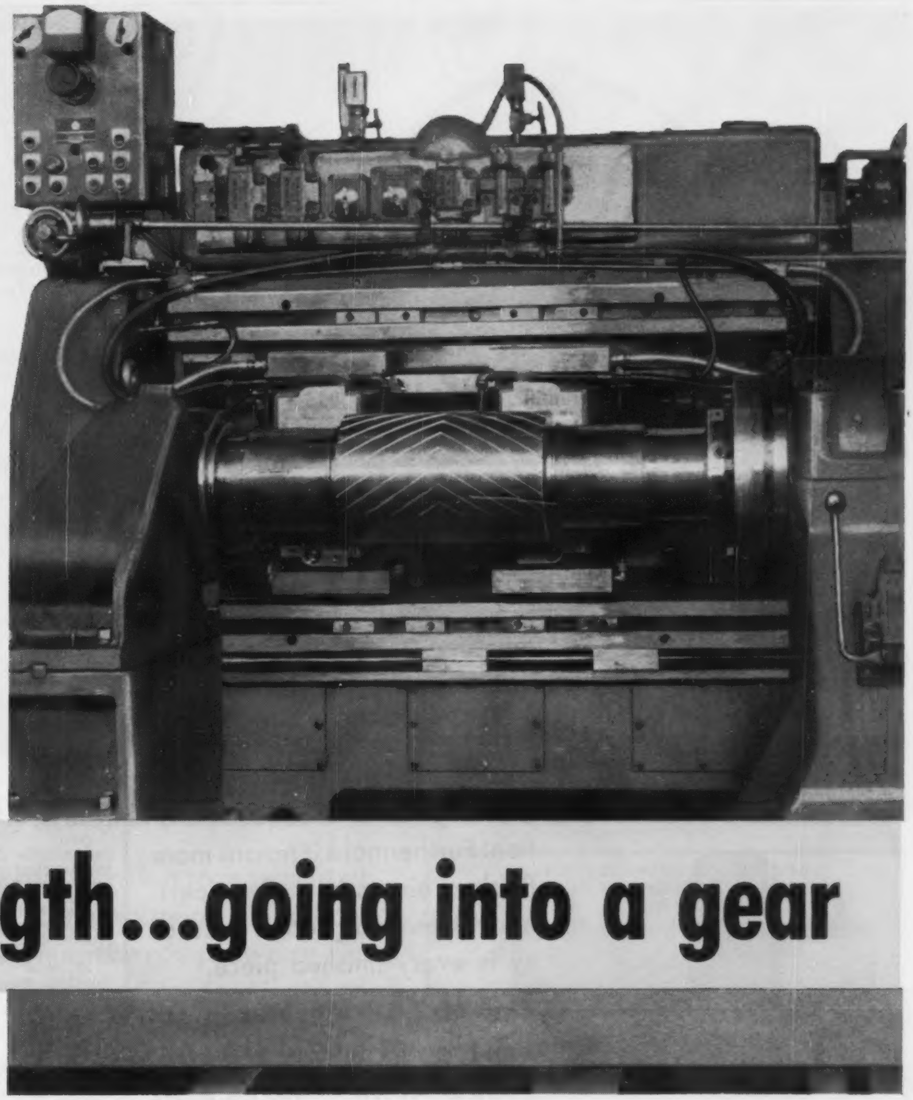
**COMPOUNDS, Cleaning**

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York

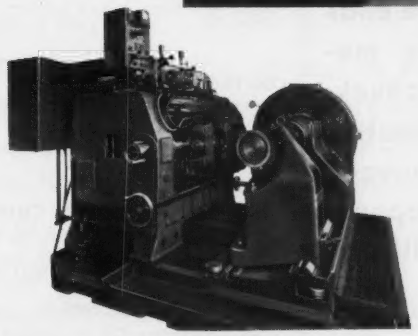
**COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.**

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).

(*Continued on page* 278)



# Strength...going into a gear



In the photograph, a Farrel-Sykes gear generator is cutting the two helices of a continuous-tooth herringbone gear, simultaneously—*without a center groove.* This unique method of gear generation puts the *entire* face width of the gear to work, providing extra strength and greater load-carrying capacity.

Extreme accuracy of tooth spacing, profile and helix angle is going into the gear, too. This pays off in smooth, quiet, uniform power flow and prolonged gear life.

The "Twin-Head" generator makes fast, simple work of cutting every type of herringbone gear, single helical and spur gears, two members of a cluster gear at the same time, and other toothed and cylindrical forms.

Write for details.

**FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.**

*Plants:* Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
*Sales Offices:* Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

Farrel-Birmingham®

FB-1016

For more information on products advertised, use Inquiry Card, page 235

Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

**COMPOUNDS, Resin and Molding**

General Electric Co., Schenectady 5, N. Y.

**COMPRESSORS, Air**

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

**CONTOUR FOLLOWER**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

**CONTRACT WORK**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Lees-Bradner Co., Cleveland, Ohio
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

**CONTROLLERS**

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**CONVEYORS FOR DUST, CHIPS, ETC.**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

**COOLANT SEPARATORS**

See Separators, Oil or Coolant

**COUNTERBORES**

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.

(*Continued on page* 280)

For more information on products advertised, use Inquiry Card, page 235

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

**COUNTERSHAFTS**

Standard Pressed Steel Co., Jenkintown, Pa.

**COUNTERSINKS**

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Jarvis Corp., Middletown, Conn.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13 Mich.
Union Twist Drill Co., Athol, Mass.

**COUNTERS, Revolution**

Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

**COUNTING DEVICES**

Starrett, The L. S., Co., Athol, Mass.

**COUPLINGS, Flexible**

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**COUPLINGS, Shaft**

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

**CRANES, Electric Traveling**

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

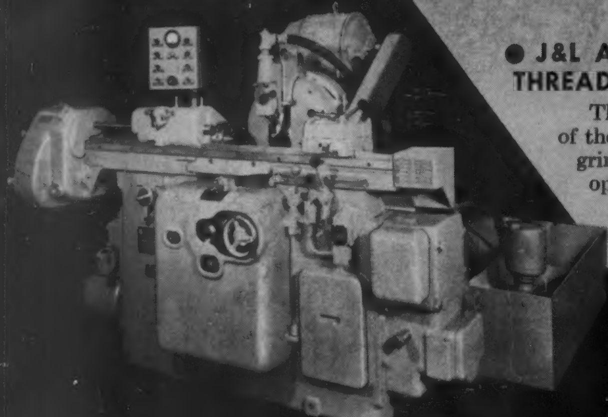
**CUTTER GRINDERS**

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

(*Continued on page 284*)

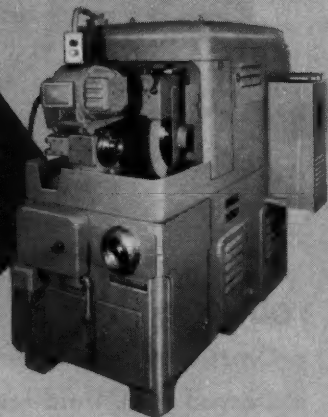
For more information on products advertised, use Inquiry Card, page 235

# Looking for higher production



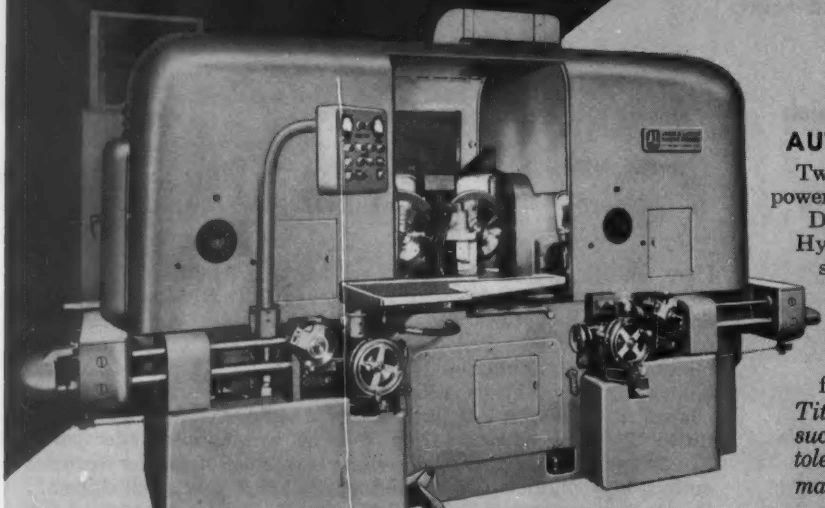
**● J&L AUTOMATIC THREAD GRINDER**

The self-trueing, self-sizing mechanism of these machines has made thread grinding a practical, profitable production operation. They can be arranged for plunge grinding single or multiple grooves or contours, and for grinding threads with multi-rib wheels, either diamond or crush dressed.



**MODEL E AUTOMATIC FORM GRINDER ●**

Completely automatic cycle. High speed approach, wheel feed spark-out and withdrawal are positively controlled through simple cam action, ensuring constant, uniform operation under all conditions.



**● MODEL D DUO WHEEL AUTOMATIC FORM GRINDER**

Two 20″ dia. grinding wheels, powered by 20 HP A.C. motors, or D.C. with rheostat control. Hydraulically operated vertical slide, mounts work holding fixtures. The stroke may be adjusted to accommodate a variety of work. These models are equipped with full vapor control.

*Titanium alloys have been successfully ground to tolerances with this machine.*

**JONES & LAMSON MACHINE COMPANY**

Jones & Lamson offers you a choice of methods for acquiring modern, profit-producing J&L equipment. In addition to outright purchase, J&L makes available several different "Pay-from-Productivity" plans at interest rates of 3¼% and lower (add-on), and a broad variety of leasing plans.

Send today for complete information. Simply fill in the coupon, *clip it to your letterhead and mail.*

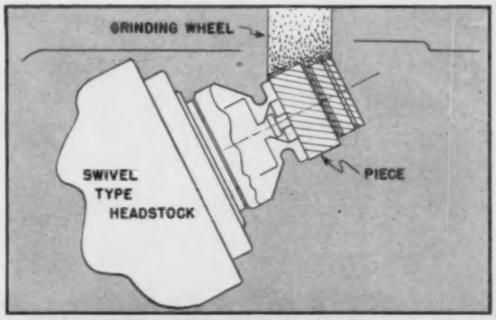
# and greater accuracy?

# ...why not GRIND IT?

Newly developed materials, plus the constant demand for higher production and greater accuracy, are causing industry to step up its search for better methods of producing a great variety of work. In many instances it is found that Automatic Thread and Form Grinders can perform a great many different and difficult production jobs with greater speed and precision than was ever possible with the use of conventional equipment.

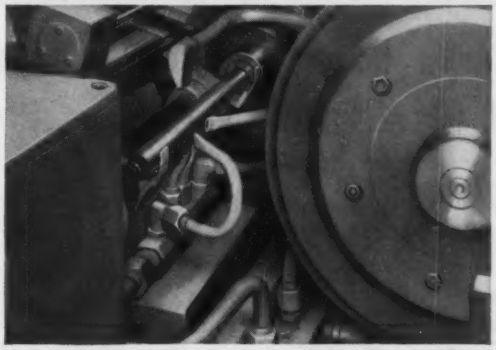
**ANGLE GRINDING**

This piece is held on an angle by an expanding air-operated arbor in the swivel type headstock of the J&L Model E. Four diam. are ground in one pass with a single wheel.



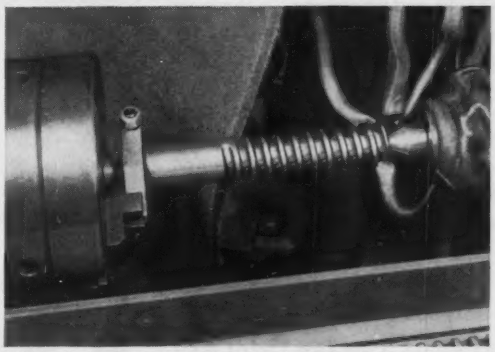

**AUTOMATIC HANDLING**

J&L Grinders are readily equipped with automatic handling for maximum output along production lines. This machine has a magazine feed for automatic loading and unloading of parts to be plunge ground for the automotive industry.



**STOCK REMOVAL**

J&L Wheel Spindles — grease packed for life, allow heavy stock removal such as on this worm (dia. 1.141″, stock removed — .1235″). Plunge ground from the solid — one cut. Increased production 160% over previous method.



**P.S.** On the basis of increased quality and more production per labor hour, we invite the opportunity to improve upon your existing methods.

**MACHINE TOOL DIVISION**

UNIVERSAL TURRET LATHES • FAY AUTOMATIC LATHES • AUTOMATIC DOUBLE-END MILLING & CENTERING MACHINES • AUTOMATIC THREAD & FORM GRINDERS • OPTICAL COMPARATORS AUTOMATIC OPENING THREADING DIES & CHASERS

**512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.**

JONES & LAMSON MACHINE COMPANY
512 Clinton St., Dept. 710, Springfield, Vt., U. S. A.

*Please send me the J&L Machine Tool Replacement Information Kit.*

*Name*..................................

*Title*..................................

For more information on products advertised, use Inquiry Card, page 235

**CUTTERS, Gear**

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**CUTTERS, Keyseater**

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**CUTTERS, Milling**

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread).
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

**CUTTERS, Rotary**

See Files & Burrs Rotary

**CUTTING COMPOUNDS**

See Compounds, Cutting, grinding, Etc.

**CUTTING AND GRINDING FLUIDS**

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

*(Continued on page 286)*

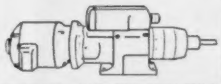
# Swanson TURRET INDEXING UNITS

*Lower the cost of Automation*

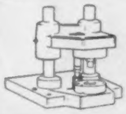
These versatile, "packaged" units provide the basic chassis for a wide range of special automatic machines for precision machining, processing or assembling operations on small and medium parts. Because they eliminate much of the engineering and building time formerly required, Swanson units lower costs and shorten completion time . . . considerably broadening the practical applications for automation. Further, because of the simplicity with which standard or special operational devices can be grouped around the turret, a wide latitude of tooling arrangements is possible. Interchangeable turret assemblies and mounting brackets are available for complete tooling changeover.

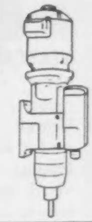
**ONLY SWANSON PROVIDES A STANDARD TURRET INDEXING CHASIS WITH THESE FEATURES:**

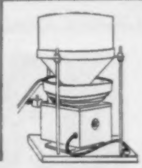
**Stationary center plate** for mounting or supporting operational devices.



**Mounting brackets** of optional widths may be located on radial keyway in any positions around the turret.

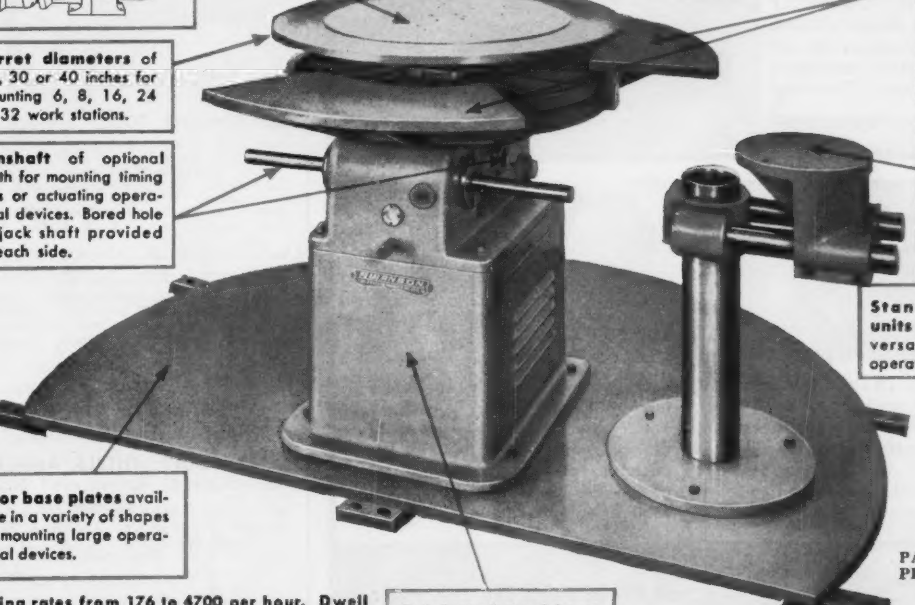






**Turret diameters** of 20, 30 or 40 inches for mounting 6, 8, 16, 24 or 32 work stations.

**Camshaft** of optional length for mounting timing cams or actuating operational devices. Bored hole for jack shaft provided on each side.



**Standard pedestal units** provide additional versatility in mounting operational devices.

**Floor base plates** available in a variety of shapes for mounting large operational devices.

PATENTS PENDING

**Indexing rates from 176 to 4700 per hour. Dwell times from .5 seconds to 15.3 seconds with direct drive . . . to infinity with intermittent drive models. Exclusive cross-over cam and locking device assure harmonious indexing and accurate positioning at all work stations.**

**Fabricated steel base** rigidly supports index housing and encloses motor, drive and wiring.

*Write for Bulletin TM*

*Quality* SWANSON TOOL & MACHINE PRODUCTS INC., ERIE, PA. *Since 1919*

**ENGINEERS AND BUILDERS OF SPECIAL AUTOMATIC MACHINERY**

Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

### CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

### CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Machine Div., American Chain & Cable, Bridgeport, Conn.
Hamilton Div., The Lodge & Shipley Co., Hamilton 1, Ohio.
Wallace Tube Co., 1304-08 Diversey Pkwy., Chicago, Ill.

### CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

### CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.

### CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### CUTTING-OFF WHEELS, Abrasive

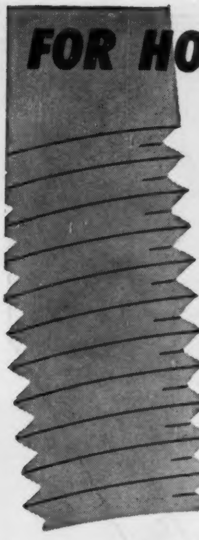
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

### CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

*(Continued on page 290)*

# FOR HOB THREADING:



- NON FERROUS METALS

...YOU NEED **HIGH SPEED!**

- HEAT TREATED MATERIALS

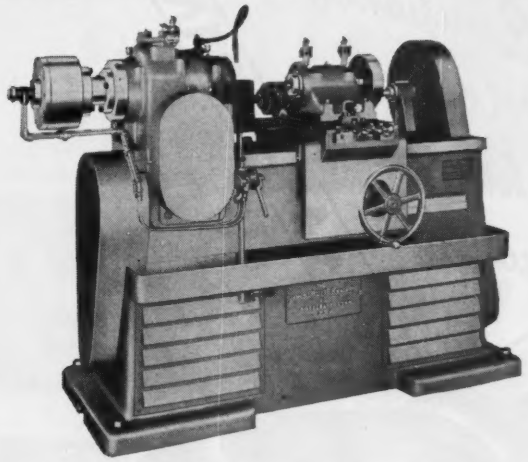
...YOU NEED **LOW SPEED!**

- VERY SHORT RUNS

...YOU NEED

**QUICK CHANGEOVERS!**

**ONLY THE COULTER "H1" GIVES ALL THREE!**



Yes sir, the COULTER "H1" Hob Thread Milling Machine is the only completely automatic machine that has such outstanding exclusive features for producing precision internal and external right-hand and left-hand threads — *ON A PRODUCTION BASIS!*

In addition, it's (a) fully **AUTOMATIC**, (b) works equally well with universal or air operated chucks, or, special fixtures, (c) has work spindle with an extra large hole, (d) work can be inserted from face to rear end, (e) has pick-off gears and an adjustable sheave drive. ***It's the machine for you!***

**EXTRA** *For Brass, Aluminum and Steel.*
The "H1" makes provision for a separate motor to give the cutter and work spindle a larger range of speeds and feeds for threading these materials.

*Send for complete information on the "H1" and other Coulter Automatic Threading Machines — no obligation.*

**MACHINE TOOL BUILDERS SINCE 1896**

**The James Coulter Machine Co.**
643 Railroad Ave. Bridgeport 5, Conn.

# production begins with

# Columbus Die-Tool

It takes the right machinery to build your product right! Columbus Die-Tool individually designs and builds tools, dies, and special machinery to produce your product alone. This gives you the advantages of lower operating cost, greater production and a higher quality product.

Let Columbus Die-Tool's more than 46 years of designing and engineering experience go to work for you. Contact CDT today about your special die, tool and machinery requirements.

**Columbus Die-Tool**
**AND MACHINE COMPANY**
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

# NICE... FROM ALL ANGLES!

• PERFORMANCE • APPEARANCE • COST

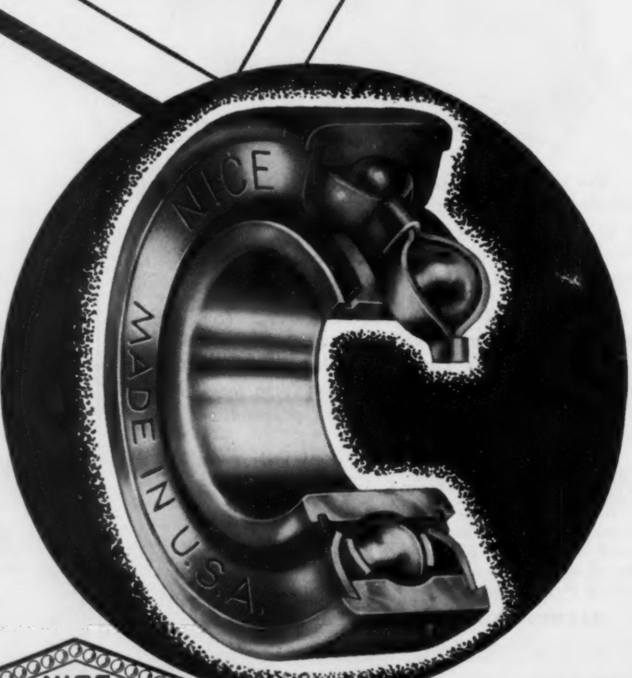
*Ball Bearings are Important Components of Most Mechanical Products*

**In product design there are three major considerations—COST, PERFORMANCE and APPEARANCE. The proper design combination of these with respect to every component, determines the success of the product, mechanically and commercially.** ***Ball Bearings are important components of most mechanical products.***

**NICE BALL BEARING COMPANY produces complete lines of precision, semi-precision and unground standard and special bearings. Hence, NICE offers the Product Designer the advantage of a diversified product and experience . . . and NICE engineers are well qualified to select or design the economic and mechanically correct bearing answers to application problems.**

**HAVE YOU ANY BEARING PROBLEMS ON WHICH NICE CAN BE OF HELP?**

**Write for Catalog No. 150**

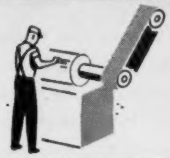



NICE

**NICE BALL BEARING COMPANY**
**NICETOWN · PHILADELPHIA · PENNSYLVANIA**

Down

MANUAL

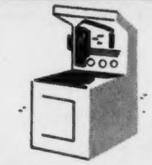


SEMI-AUTOMATIC

the years

with

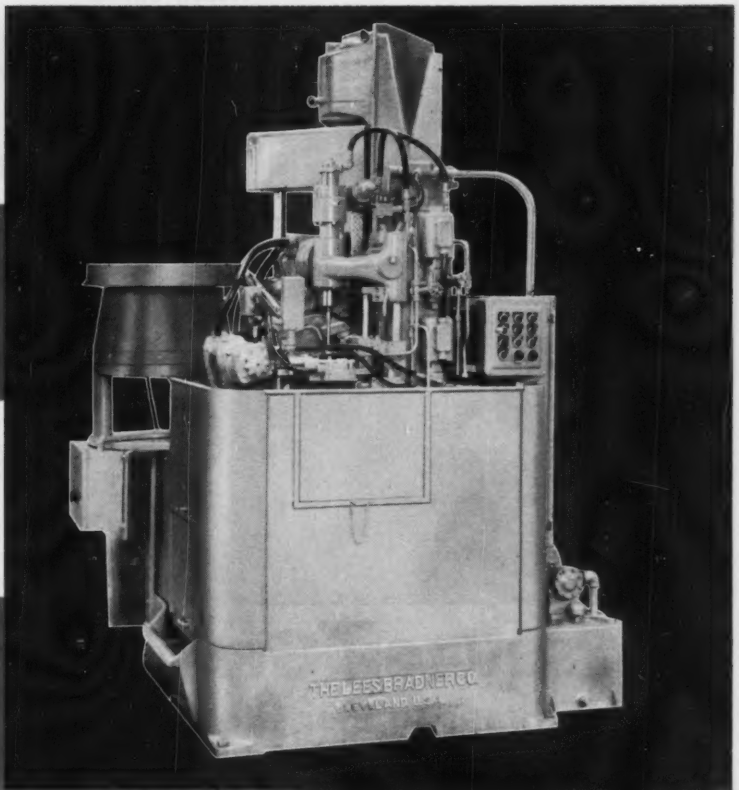
AUTOMATIC



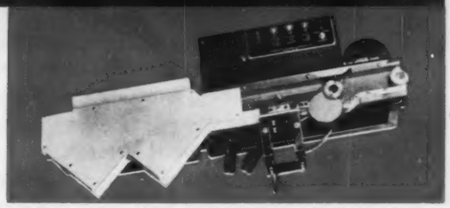
SELF LOADING & UNLOADING

machine

tools




...and now the NEWEST



# AUTO MOTION®

THE MACHINE TOOL SHOW CHICAGO, ILL. SEPT. 6-17, 1955 INTERNATIONAL AMPHITHEATRE

## MACHINES THAT THINK FOR THEMSELVES

Moving ever forward in the development of new gear-hobbing methods, Lees-Bradner now presents a hobber that *electronically* corrects tolerances while the machine is in action.

The secret lies in an "electronic brain" that checks the finished gears as they come from the hobber and makes corrections as necessary in pitch diameters or root fillets by electrically shifting the hob between cycles.

This is truly a revolutionary step forward in gear hobbing efficiency . . . time-saving as well as money saving.

If you, too, want to stop manufacturing "scrap" in your hobbing operations by catching off-tolerance pieces *before* they're hobbed, get the whole story from your Lees-Bradner representative. Or, write to us direct.

**the LEES-BRADNER Company**

CLEVELAND 11, OHIO - U.S.A.

For more information on products advertised, use Inquiry Card, page 235

### CYLINDERS, Air

Hannafin Corp., 501 Wolf Rd., Des Plaines, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

### CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

### CYLINDERS, Pneumatic

Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.

### DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

### DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Walker, O. S. Inc., Worcester, Mass.

### DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

### DIAMONDS AND DIAMOND TOOLS

Christensen Diamond Prod., 1937 S. Second West, Salt Lake City, Utah
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

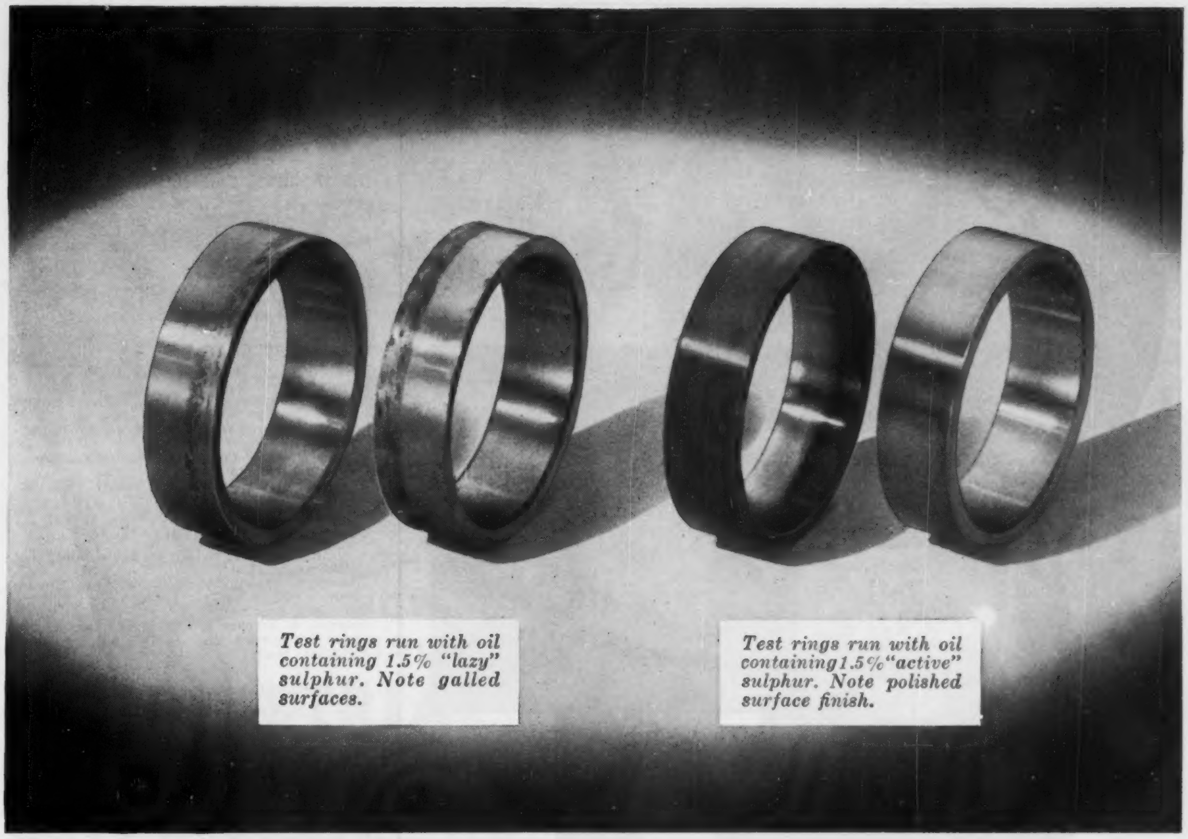
### DIE-CASTING

See Castings, Die

### DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engineering Corp., Kenmore Station Buffalo, N. Y.

*(Continued on page 292)*




# Only ACTIVE Sulphur Provides Fluid Lubrication Under Extreme Pressures

This comparative test proves it! Both tests were run on an SAE Lubricant Tester using two oils with the same percentage of sulphur. The specifications were similar—but look at the results!

The set of rings on the left were run with an oil containing "lazy" sulphur that did not provide the necessary anti-weld qualities. Under the heavy loads present in the test, the rings quickly galled and seized. The pair on the right were run with an oil containing "active" sulphur, the *only* type of sulphur that will prevent galling or seizure. It is performance that counts, not specifications.

"Active" sulphur in a cutting oil, readily reacts with the metal surfaces of the tool, chip and workpiece to produce metallic sulphide films that become fluid lubricants when sufficient heat is generated, and provide lubrication under the high temperatures that exist in the cutting orbit.

Stuart Oil Company's Shop Note Book, Bulletin S-2, contains further information on how to select a sulphurized cutting oil. Write for your copy today, and ask to have "the Man in the Barrel", your Stuart Representative, call too. He will help you select the cutting fluid that will provide the very best results under the conditions you will subject it to.

**D. A. STUART OIL COMPANY, LTD.**
**2739 S. Troy St., Chicago 23, Ill.**

**More than a "Coolant" is Needed**

**Stuart Oils**

*Time Tested Cutting Fluids and Lubricants*

*Plants in:* Chicago, Detroit, Cleveland, Hartford, and Toronto, Ontario.

Branch Warehouses and Representatives in principal metal working centers in the United States, Canada and Europe.

For more information on products advertised, use Inquiry Card, page 235

### DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

### DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennamental Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

### DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### DIEMAKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnatti Milling Mach. Co., Oakley, Cincinnati 9, Ohio.
Grob, Inc., Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

### DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 225 N. 18th St., Ampere, N. J.
Wales-Strippet Corp., North Tonawanda, N. Y.

### DIE-SINKING MACHINES

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Groton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Turchon Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

### DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

### DIE STOCKS

See Stocks, Die

### DIES, Sheet Metal, Etc.

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mach Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Mullins Mfg. Corp., Salem, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Waltham Mch. Wks., Newton St., Waltham, Mass.

*(Continued on page 294)*

"Buffalo" DRILLS

# NOT BUILT FOR DO-IT-YOURSELFERS

## NOW, AS ALWAYS, BUILT FOR ONE USE

# —INDUSTRIAL DRILLING

. . . not that you won't find this husky No. 15 Drill in home workshops. Men who appreciate fine tools are always on the lookout for a "Buffalo" Drill-press.

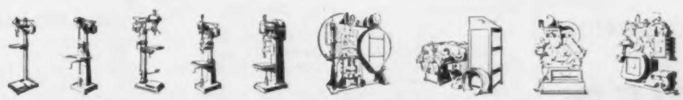
But the fact is, they're built strictly for the punishing service, accuracy and high production of the commercial shop. Instead of chrome trim, fancy paint jobs and sales-appealing gadgets, you'll find features like the "Buffalo" one-piece, 6-spline spindle turning on ball bearings — easy, convenient feed controls, fast setup adjustments — overall solidity of construction. This "Q" Factor* construction has always paid off in lower drilling costs.

Why not specify "Buffalo", the Drills built for *industrial* work.

**The "Q" Factor — the built-in quality which provides trouble-free satisfaction and long life.*

"Buffalo" No. 15 Drill — an all-around heavy-duty production machine, available in all popular arrangements with a wide variety of attachments to fit your requirements. ½" capacity. Write for Bulletin 296B-G.

THE MACHINE TOOL SHOW
CHICAGO, ILL.



ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

**BUFFALO FORGE COMPANY**

440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

For more information on products advertised, use Inquiry Card, page 235

**DIES, Threading**

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

**DIES, Threading, Opening**

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**DIES, Thread Rolling**

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**DISCS, Abrasives**

Besley-Welles Corp. (Abrasive Div.) 20 N. Wacker Drive, Chicago 6, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St. Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

**DISINTEGRATORS**

Elox Corp., 602 N .Rochester Rd., Clawson, Mich.

**DIVIDING HEADS**

See Indexing and Spacing Equipment

**DOWELL PINS**

Ollen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**DRESSERS, Grinding Wheel**

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Sherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.

**DRIFTS, DRILL**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILL HEADS, Multiple Spindle**

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 400 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., Detroit 8, Mich.
Jarvis Corp., Middletown, Conn.
Millholland, W. K. Machinery Co., 6402 West-field Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zager Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILL HEADS, Unit Type**

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 West-field Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

**DRILL SOCKETS**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILL STANDS**

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILL STOPS**

Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

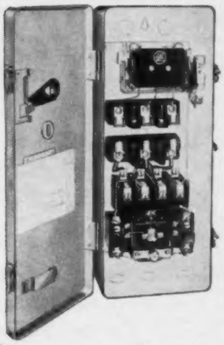
**DRILLING MACHINES, Automatic**

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.

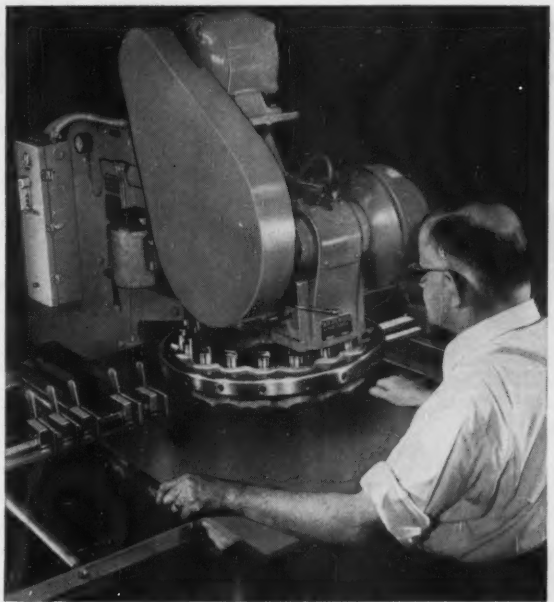
*(Continued on page 296)*



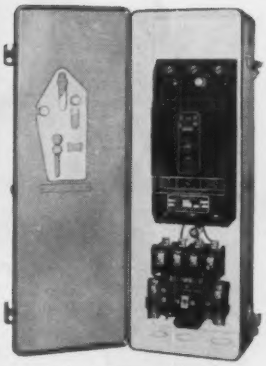
For more information on products advertised, use Inquiry Card, page 235



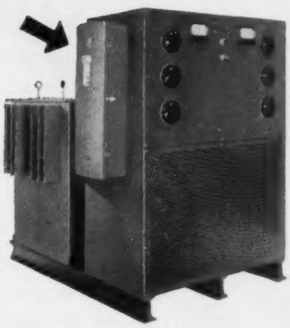
Bulletin 712 combination starter with manual, fused disconnect and solenoid starter in NEMA Type 1 general purpose enclosure



Weidemann turret punch press equipped with Allen-Bradley Bulletin 712 combination starter



Bulletin 713 combination starter with I-T-E circuit breaker and solenoid starter in NEMA Type 1 general purpose enclosure



A-B comb. starter on CELAB 50 kw. selenium rectifier

# BULLETIN 712-713 COMBINATION STARTERS

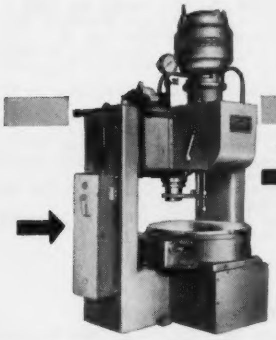
## MAKE MORE COMPACT and SAFER CONTROL INSTALLATIONS

Many motorized machine installations call for a manual disconnect or circuit breaker ahead of the magnetic starter. In such cases, do not order the two units in separate enclosures . . . specify Allen-Bradley combination starters, which have both units in ONE enclosure.

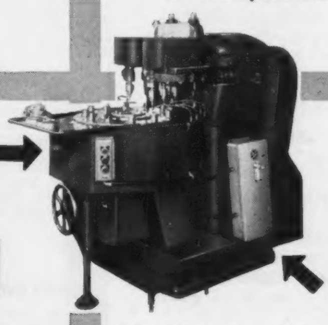
The cost—taking installation time into consideration—is usually less. The combination starter is "safe" for the operator. Cabinet cannot be opened unless disconnect lever is in OFF position. Starter and fuses are then "dead."

The magnetic starters in these combination starters are Allen-Bradley Bulletin 709 solenoid starters with double break, silver alloy contacts that need no maintenance. Thermal relays give continuously reliable overload protection.

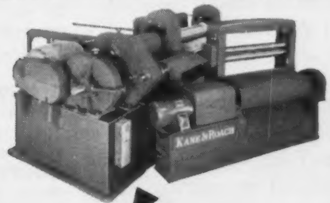
Send for Bulletin 712-713.



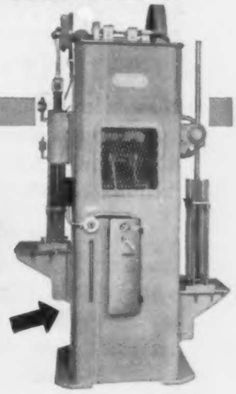
A-B combination starter on Loomis 100 ton hydraulic press



A-B comb. starter on Globe multiple tapping machine



A-B comb. starter on Kane & Roach slitting machine



A-B combination starter on Link spring fatigue tester

Allen-Bradley Co.
1331 S. First St.
Milwaukee 4, Wisconsin

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ont.

**ALLEN-BRADLEY**
**SOLENOID MOTOR CONTROL**
QUALITY

For more information on products advertised, use Inquiry Card, page 235

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Wales-Strippet Corp., North Tonawanda, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILLING MACHINES, Bench**

Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

**DRILLING MACHINES, Boiler**

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burr Co., 1300 St. Clair Ave., Cleveland.

**DRILLING MACHINES, Deep Hole**

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Wales-Strippet Corp., North Tonawanda, N. Y.

**DRILLING MACHINES, Gang**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burr Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

**DRILLING MACHINES, Horiz.**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.

*(Continued on page 298)*

For more information on products advertised, use Inquiry Card, page 235

Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch Tool Co., 2531 11th St., Rockford, Ill.

**DRILLING MACHINES, Horizontal Portable**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

**DRILLING MACHINES, Inverted**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

**DRILLING MACHINES, Multiple Center Column Type**

Avey Drilling Mch., Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

**DRILLING MACHINES, Multiple Spindle**

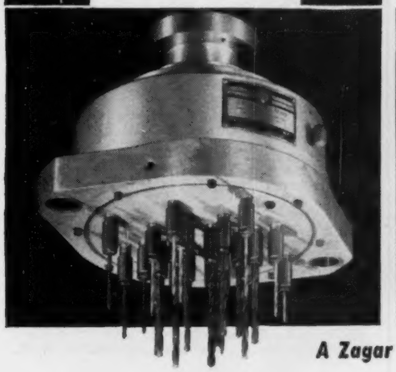
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St. Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Michigan Drill Head Co., Detroit 34, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

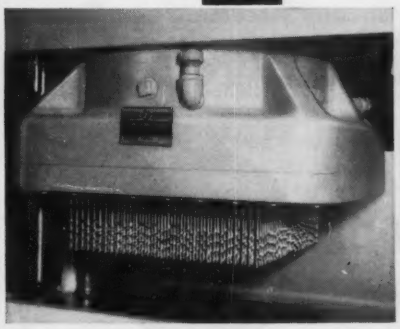
*(Continued on page 300)*

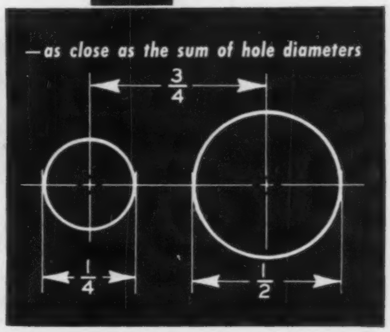
# Zagar Gearless Drill Heads

## put 4 big advantages to work for you

**Any number of holes** — **Any hole pattern** — **Any material** — **On all centers**



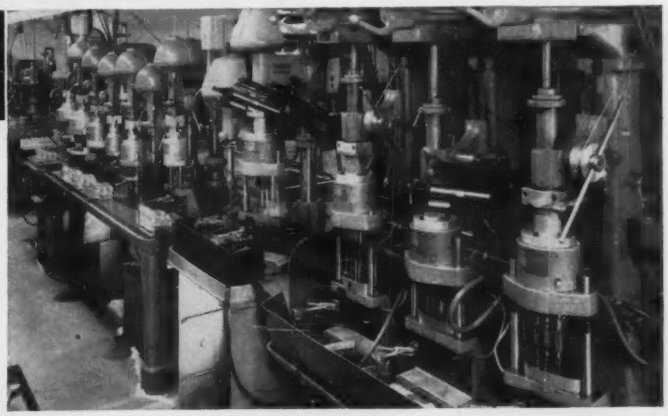





***A Zagar drill head is never obsolete. Zagar can re-locate spindles for other hole patterns.***

Can you visualize the savings made possible by drilling up to 1000 holes at one pass? Zagar standard practice can handle any machinable material up to 1½" diameter. Holes of varying diameters can be drilled to form any pattern. Zagar Gearless Drill Heads, their efficiency proven by many years' success, can be installed on existing drill presses. Or, Zagar will lay out the necessary tooling for your entire job. May we see your sample parts and study your requirements? There is only one *right* answer—one *best* answer—for those requirements. May we supply it?

## Let ZAGAR tooling plan the complete job for you



Whether your runs are long or short, let Zagar engineering survey your needs with a view to saving you the cost of special machines. In the case at the right two lines of *standardized* self-clamping drill jigs ream, tap and drill an aluminum die casting, both valve body and cover. The problem of limited production was readily solved. What, sir, are your requirements?

**ZAGAR TOOL, INC.** 24000 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

**Zagar** TOOLS FOR INDUSTRY and SPECIAL MACHINERY

*Get more information via Zagar's Engineering Manual "M-7".*


For more information on products advertised, use Inquiry Card, page 235

**DRILLING MACHINES, Radial**

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

**DRILLING MACHINES, Rail**

See Drilling Machines, Gang

**DRILLING MACHINES, Sensitive**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

**DRILLING MACHINES, Upright**

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippet Corp., North Tonawanda, N. Y.

**DRILLING MACHINES, Wall, Radial**

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

**DRILLS Center**

The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILLS, Core**

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(Continued on page 302)

# 3 Reasons Why

## *Taft-Peirce Superpower Magnetic Chucks Save You Money*

**1 — You get the "right" chuck for every job.** T-P offers you a complete line of *both* Electromagnetic and Permanent Magnet Chucks. A P-M Chuck has no wires to fail . . . no current to heat . . . it's the safest, most economical choice for many jobs. Ideal for grinding, light milling, planing, shaping, and bench work. Since we also make electromagnetic chucks, we'll be glad to advise you which is best for your job.

**2 — T-P Cost-Cutting Designs.** T-P offers you a selection of work-saving models — in practically all standard sizes and shapes. Maybe you need a T-P Superpower Chuck that tilts or swivels to save setup time. Or a fine mesh chuck to hold small or thin sections. Or a longitudinal pole chuck for greater versatility. Taft-Peirce makes them all and many more. Plus practically any special design you may need.

**3 — Maximum Power and Performance.** Taft-Peirce Superpower Magnetic Chucks combine maximum holding power with maximum working surface. Magnetic losses are low. Safety factors generous. Rugged, rigid, one-piece all-steel body is waterproof and shockproof. Little or no maintenance is ever required.


*For information on Superpower Chucks and other items send for your copy of the Taft-Peirce Handbook.*

**THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND**

**DRILLS, Deep Hole**
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILLS, Portable Electric**
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

**DRILLS, Portable Pneumatic**
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

**DRILLS, Rachet**
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILLS, Spade**
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

**DRILLS, Subland**
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.

**DRILLS, Twist**
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DRILLS, Wire**
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**DUPLICATORS**
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

**DUST COLLECTORS**
Pangborn Corp., Hagerstown, Md.

**DUST CONTROL SYSTEMS**
Pangborn Corp., Hagerstown, Md.

**ELECTRICAL EQUIPMENT**
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**EMERY WHEEL DRESSERS**
See Dressers, Grinding Wheel

**EMERY WHEELS**
See Grinding Wheels

**END MILLS**
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.

**ENGRAVING MACHINES**
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

**EXTRACTORS, Drill**
Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

**EXTRACTORS, Screw**
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

*(Continued on page 304)*

# Logan

## Air-Draulic®

## FEED CONTROLLED CYLINDERS

Combine The Fast-Acting, Economical Low-Pressure Operation Of . . . . . . **AIR**

With The Smooth, Uniform Controlled Regulation Of. . . . . . . . **OIL**

. . . for Pushing, Pulling, Pressing, Clamping, Holding, Lifting, and Other Power Movements In Any Direction

Air-Draulic Cylinder with Flange Mounting at Rod End

**5 STANDARD MOUNTING TYPES**

Standard bores from 3" to 8". Any stroke to 5'. For air pressure to 150 psi. Power movement in any direction. No power unit required. Feeds as low as 1.150 ipm; lower speeds special on request.

## NO POWER UNIT REQUIRED

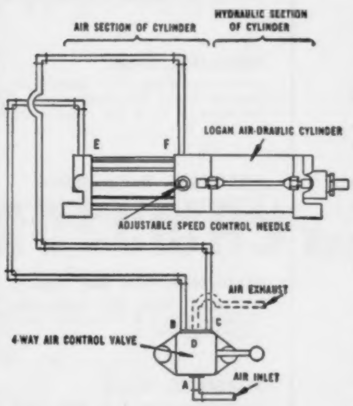
Basically, Logan AIR-DRAULIC® Cylinders are *air cylinders*, and may be used wherever compressed air is available. Yet they provide the smooth, uniform, controlled feed which is normally obtained only in *hydraulic cylinders.*

Reduced to its simplest terms, the Logan AIR-DRAULIC Cylinder is an integral unit consisting of an air piston and a hydraulic piston mounted on a single rod. The thrust or pull of the rod is obtained by means of the air cylinder, controlled by a valve or valves in the usual manner. The two chambers in the hydraulic cylinder are connected externally in a self-contained circuit; an adjustable speed control valve in this circuit regulates the flow of oil and hence the speed of the rod stroke.

*Rapid return* is made possible by a check valve in the hydraulic piston, permitting unobstructed oil flow on the return stroke. *Controlled feed in both directions* is also available by omitting the check valve. *Skip-feed* can be obtained through the use of cam valves applied externally in the hydraulic circuit.

The hydraulic circuit is self-contained, and no power unit is required. Logan AIR-DRAULIC Cylinders can be equipped with an automatic oil filler if desired.

Member—National Tool Builders Assn.
National Fluid Power Assn.




**Basic AIR-DRAULIC Circuit with 4-Way Control Valve No Power Unit Required**

## HOW TO INSTALL AIR-DRAULIC CYLINDERS

The basic circuit for installation of Logan AIR-DRAULIC Cylinders is shown at the left. The air section of the cylinder is connected in the same manner as a standard double-acting air cylinder, a 4-way air control valve, piping and a connection to the main air line being required. A hand-operated air valve is illustrated, but foot-operated or other types of air valves may be used. The hydraulic section of the cylinder is a self-contained circuit and requires no additional equipment or connections.

Piping is arranged from ports B and C on the air valve to ports E and F, respectively, on the air section of the AIR-DRAULIC Cylinder. Port A is the air inlet port and port D the exhaust.

The desired piston speed is obtained by setting the adjustable needle on the hydraulic section of the cylinder. Controlled speed may be obtained on the out-stroke, the in-stroke, or both, through the internal arrangements of the hydraulic cylinder.

Logan

Saves Time · Logan · Air and Hydraulic Equipment · Effort · Motion

**LOGANSPORT MACHINE CO., INC.**
**810 CENTER AVE., LOGANSPORT, IND.**

**Let Logan engineers help you design your Air and Hydraulic Circuits. No obligation.**

**LOGAN MANUFACTURES 7,023 STANDARD CATALOGED ITEMS**

FREE CATALOG ON REQUEST

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3 • AIR and HYDRAULIC PRESSES, Cat. 51 COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4 HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 SURE-FLOW COOLANT PUMPS, Cat. 62.

For more information on products advertised, use Inquiry Card, page 235

**FACING MACHINES**
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

**FANS, Exhaust, Electric Ventilating**
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

**FEEDS FOR PRESSES, Automatic**
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**FELT, For All Applications**
American Felt Co., Glenville, Conn.

**FILES, Hack**
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

**FILES, Hand**
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

**FILES, Machine**
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**FILES AND BURS, Rotary**
The Atrax Co. (Carbide) 240 Day St., Newington 11, Conn.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jarvis Corp., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**FILING MACHINES, Dies, Etc.**
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**FILTERS, Coolant and Oil**
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

**FINISHES FOR MACHINE AND METAL PARTS**
Lowe Bros. Co., Dayton, Ohio.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

**FIXTURES, Kits for Building**
Precision Tool Kits, Inc., 448 Soo Line Lane, Schiller Park, Ill.

**FLEXIBLE COUPLINGS**
See Couplings, Flexible

**FLEXIBLE SHAFT EQUIPMENT**
Jarvis Corp., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.

**FORGINGS, Machines (Upsetting)**
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

**FORGINGS, Drop**
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**FORGINGS, Hollow Bored**
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

**FORGINGS, Iron and Steel**
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

**FORGINGS, Upset**
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**FORMING AND BENDING MACHINES**
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidatd Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.

(Continued on page 306)

Erie Foundry Co., Erie, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1304-08 Diversey Pkwy., Chicago, Ill.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

### FORMING AND STAMPING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Gerrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

### FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

### FRAMES, Machinery Welded

Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Mahon, R. H. Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

### FURNACES, Heat-Treating

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

### FURNITURE, Shop

Standard Pressed Steel Co., Jenkintown, Pa.

### GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

### GAGES, Air

Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### GAGES, Comparator

Ames, B. C., Co., Waltham 54, Mass.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### GAGES, Depth

Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### GAGES, Dial

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### GAGES, Electric

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

### GAGES, Height

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.

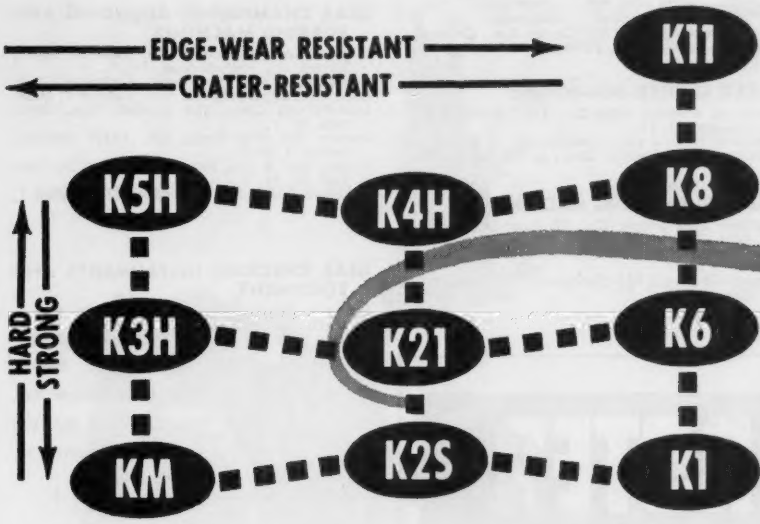
### GAGES, Plug, Ring and Snap

Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Elgin National Watch Co., Aurora, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

### GAGES, Surface

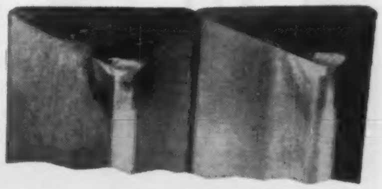
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 308)




# K21

## Shows Exceptional Wear Resistance



Grade K21, on the left, shows less wear than competitive grade (at right) after turning 100 pieces.

# Use Grade K21—the NEW Kennametal* General Purpose Steel-Cutting Grade

The Grade Selection Guide (above), which groups Kennametal grades according to strength, hardness, and wear characteristics, pinpoints the *new* K21 as a medium grade for general purpose steel-cutting applications. It is stronger than K5H, K4H, and K8. It has greater edge-wear resistance than K3H and KM, and more crater resistance than K11, K8, K6, and K1. Thus, K21 is for moderate, as well as heavy roughing of scaly, abrasive steel castings and forgings, and for interrupted cutting and milling operations requiring high resistance to edge wear, to cratering, and to shock. K21 shows exceptional performance on modern high-speed machines, and, due to its range, does an excellent job on older, slower-speed machines as well.

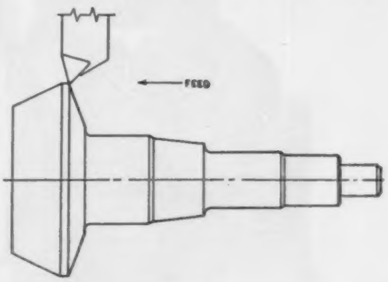
Because of this performance, K21 is rapidly becoming recognized as the leader of all general purpose steel-cutting grades. It's a premium grade at no extra cost. Ask your Kennametal Representative for performance facts; and for a copy of the Grade Selection Guide shown above . . . it's the most simple system of selecting the right grade for every job that has ever been developed.

## Kennametal Engineers are ready to help you

Every Kennametal Representative is a tool engineer. He is trained to help you analyze tool wear—apply the right tool and grade to the job—establish proper lathe speeds and feeds—train machinists to get increased production at the lowest possible cost with Kennametal Tools. In addition to his own broad experience, he has available to him the backgrounds of 150 other Kennametal Tool Engineers. His office is listed in the classified telephone directory in principal cities. Call him, or write KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark

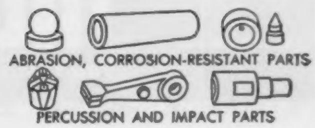
Four competitive grades of cemented carbides were used in a recent comparative test machining SAE 4620 rear axle drive pinion forgings. (See drawing below.) Each grade was removed for examination of the cutting edge after turning 100 pieces. The competitive inserts showed sufficient wear to require indexing to a new cutting edge, while the Grade K21 insert (at left above) turned 200 additional pieces before it was indexed. This 3 to 1 ratio in tool life typifies the results being obtained on many types of machining jobs with this *new* Kennametal grade, including forgings, sandy castings, centrifugal castings, plate, weldments and highly abrasive silicon steels.




VISIT US AT THE MACHINE TOOL SHOW
Chicago, starting Sept. 6, 1955
Booths 410-411, Navy Pier, and
Booth 123, Chicago Amphitheater

7257


INDUSTRY AND KENNAMETAL
...Partners in Progress




For more information on products advertised, use Inquiry Card, page 235

**GAGES, Taper**

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

**GAGES, Thread**

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Taft-Peirce Mfg. Co., Woonsocket, R. I.

**GASKETS**

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.

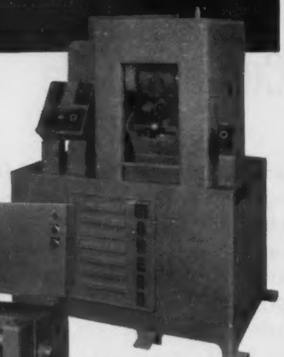
**GEAR BLANKS, Non-Metallic**

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

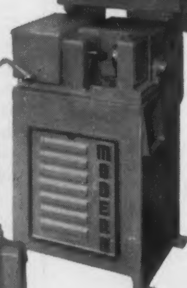
**GEAR BURNISHING MACHINES**

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

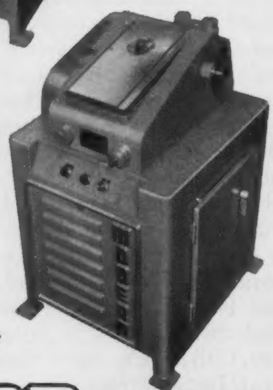














**GEAR CHAMFERING, ROUNDING AND BURRING MACHINES**

Bilgram Gear & Mch Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

**GEAR CHECKING INSTRUMENTS AND EQUIPMENT**

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

**GEAR CUTTING MACHINES, Bevel Gears (Generators)**

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

**GEAR CUTTING MACHINES Bevel Gears, Spiral**

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

**GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)**

Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.

**GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)**

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

**GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)**

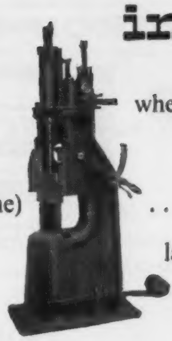
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

**GEAR CUTTING MACHINES, Worm and Worm Wheels**

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

*(Continued on page 310)*

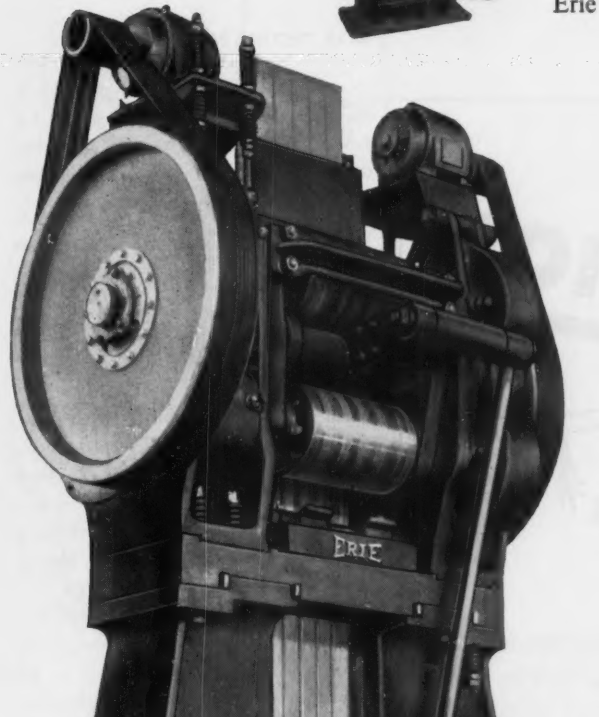
# in the good old days



when Erie Foundry was *the first* to use all-steel construction in all our hammers

(such as this 100 lb. single frame)

...... and when hammermen thought a board drop hammer larger than 5,000 lbs. was a wild dream .... even then Erie Foundry was a great name in forging hammers




# today

Erie Foundry has recently built the world's largest board drop hammer. This 10,000 lb. hammer is at work for Eaton Manufacturing Co's Marion, Ohio forge plant. Eaton is forging 68 lb. net, Flat Back Ring Gears, 16" in diameter, in a single impression die, straight down without blocking or pancaking.

In addition to forging large gears speedily, Eaton likes the Erie 10,000 lb. Board Drop Hammer because the 4-roll lifting head gives longer board life. Air operated board clamps ease the hammerman's job.

As in the good old days, this 10,000 lb. board drop hammer is all-steel . . . and made by Erie.

in our 60th year

ERIE

*The Greatest Name in Forging Hammers*

**ERIE FOUNDRY CO. ERIE, PA.**

For more information on products advertised, use Inquiry Card, page 235

## GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

## GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

## GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

## GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.



## GEAR MOTORS

See Speed Reducers.

## GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

## GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

## GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Lees-Bradner Co., Cleveland, Ohio
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Westinghouse Electric Corp., E. Pittsburgh, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

## GEARS, Rawhide and Non-Metallic

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.

(Continued on page 312)

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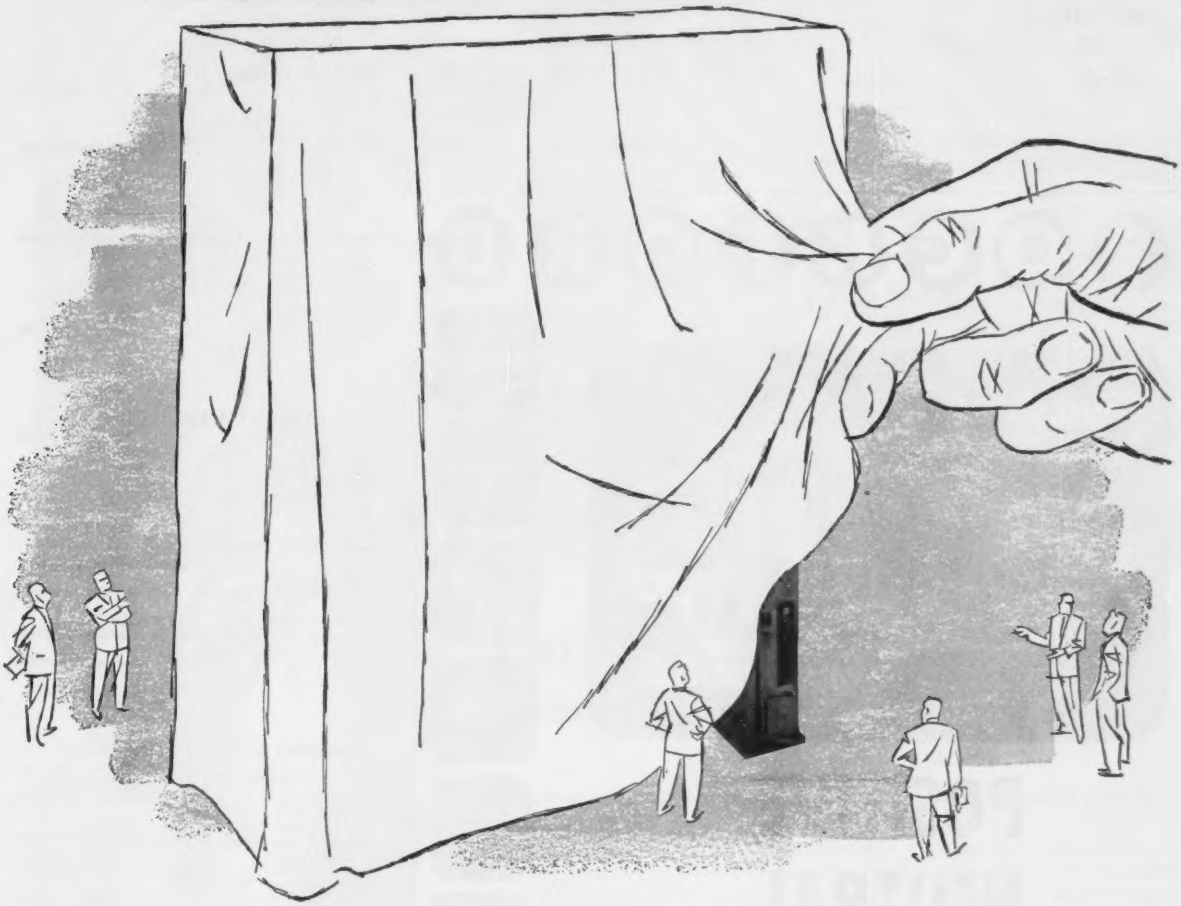

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**For more information on products advertised, use Inquiry Card, page 235**

Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadephia 25, Pa.

**GENERATORS, Electric**

General Electric Co., Schnectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**GRADUATING MACHINES**

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio

**GREASE**

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

**GRINDERS, Carbide Tool**

See Grinding Mches., Carbide Tool



**GRINDERS, Die and Mold**

Consolidated Mch. Tool Corp., Rochester, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

**GRINDERS, Oilstone, for Woodworking Tools**

Mummert-Dixon Co., Hanover, Pa.

**GRINDERS, Pneumatic**

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

**GRINDERS, Portable Electric and Toolpost**

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Geometric Tool Co., (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

**GRINDING MACHINES, Abrasive Belt**

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

**GRINDING MACHINES, Bench**

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

**GRINDING MACHINES, Broach**

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

**GRINDING MACHINES, Camshaft**

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

**GRINDING MACHINES, Carbide Tool**

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

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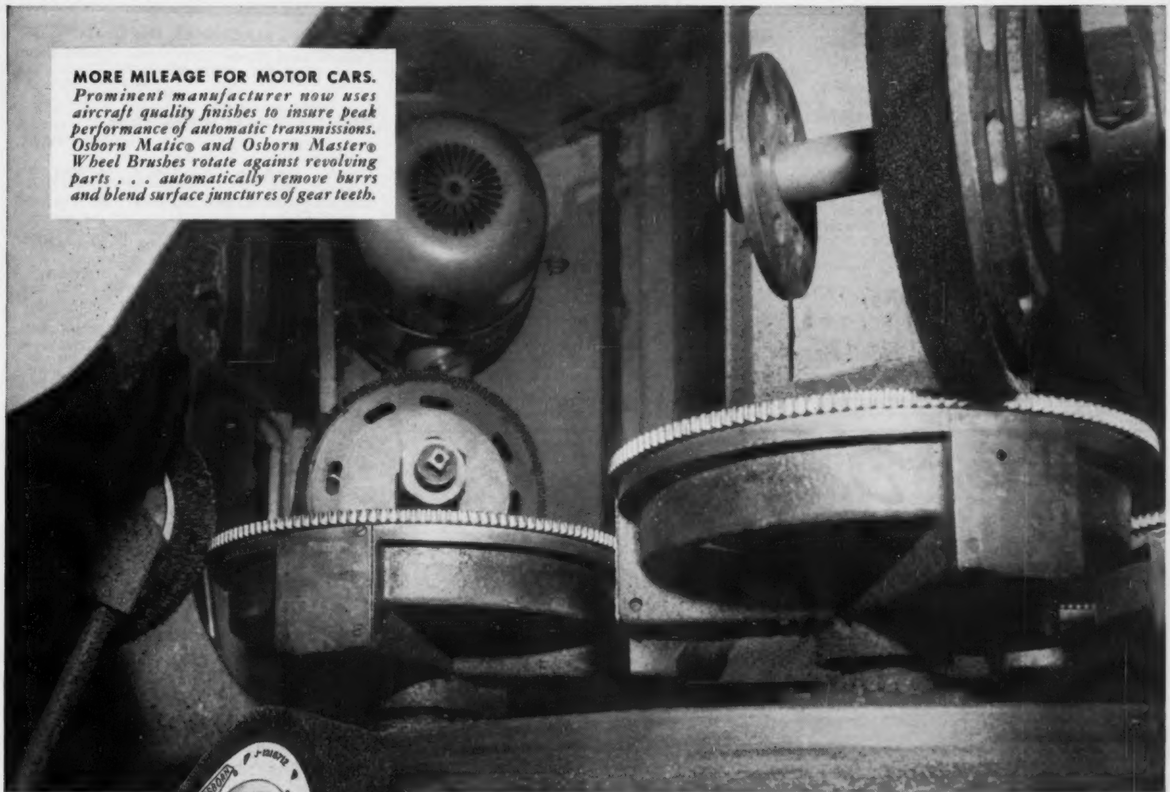

**MORE MILEAGE FOR MOTOR CARS.**
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Parts are now simply rotated against revolving Osborn Power Brushes on preset time cycles. Sharp edges or surface junctures are uniformly blended, eliminating causes of stress concentrations and possible failure. Small metal particles are removed, avoiding subsequent fouling of hydraulic and lubricating systems.

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Whatever the type of product you build, Osborn Power Brushing can improve quality and cut cost of manufacture. An **OBA**, **O**sborn **B**rushing **A**nalysis, of your job will show you how. Write *The Osborn Manufacturing Company, Dept. D-31, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

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Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernon Hwy., Detroit 1, Mich.

**GRINDING MACHINES, Centerless**

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

**GRINDING MACHINES, Chucking**

Baird Machines Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio

**GRINDING MACHINES, Crankshaft**

Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.



**GRINDING MACHINES, Die Chaser**

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

**GRINDING MACHINES, Disc**

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

**GRINDING MACHINES, Drill**

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Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

**GRINDING MACHINES, Face**

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

**GRINDING MACHINES, Flexible Shaft**

See Flexible Shaft Equipment

**GRINDING MACHINES, Gap**

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

**GRINDING MACHINES, Gear Tooth**

See Gear Grinding Machines

**GRINDING MACHINES For Sharpening Cutters, Reamers, Hobbs, Etc.**

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

**GRINDING MACHINES, For Sharpening Turning and Planing Tools**

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

**GRINDING MACHINES, Internal**

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

**GRINDING MACHINES, Jig**

Moore Special Tool Co. Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

**GRINDING MACHINES, Knife and Shear Blade**

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

**GRINDING MACHINES, Piston Ring**

Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

**GRINDING MACHINES, Profile**

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

**GRINDING MACHINES, Ring Wheel Ball Race, Etc.**

Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

**GRINDING MACHINES, Radial**

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**GRINDING MACHINES, Radius, Link**

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

**GRINDING MACHINES, Roll**

Cincinnati Miling Mch. Co., Oakley, Cincinnati 9, Ohio.
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

**GRINDING MACHINES, Spline Shaft**

Van Norman Co., Springfield, Mass.

**GRINDING MACHINES, Surface**

Abrasive Mch Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cee Mfg. Co., 21-25 44th Ave., L. I. C., N. Y.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

**GRINDING MACHINES, Tap**

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

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**GRINDING MACHINES, Thread**

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

**GRINDING MACHINES, Universal**

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

**GRINDING MACHINES, Worm**

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

**GRINDING WHEELS**

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Macklin Co., 2925 Wildwood Ave., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Precision Diamond Tool Co., 102 South Grove Ave., Elgin, Ill.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

**GROOVING TOOLS, Internal**

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

**HAMMERS, Drop**

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Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

**HAMMERS, Forging Air**

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

**HAMMERS, Pneumatic**

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

**HAMMERS, Portable Electric**

Millers Falls Co., Greenfield, Mass.

**HAMMERS, Power**

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.

**HAMMERS, Shaft**

Standard Pressed Steel Co., Jenkintown, Pa.

**HAMMERS, Soft**

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**HARDENING EQUIPMENT**

Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

**HARDENING MACHINES, Flame**

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

**HARDNESS TESTING INSTRUMENTS**

Olsen, Tinius, Testing Mch. Co., Willow Grove, Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

**HEADING MACHINES**

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

**HOBBING MACHINES**

See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

**HOBS**

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lees-Bradner Co., Cleveland, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

**HOIST HOOKS**

Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**HOISTING AND CONVEYING EQUIPMENT**
Cleveland Crane & Engrg. Co., Wickliffe, Ohio

**HOISTS, Air**
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.

**HOISTS, Chain, Etc.**
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

**HOISTS, Electric**
Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

**HONING MACHINES, External**
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

**HONING MACHINES, Internal (Cylinder)**
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

**HONING STONES**
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

**HONING TOOLS AND FIXTURES**
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

**HOSE, Leather, Rubber, Metallic, Etc.**
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

**HYDRAULIC MACHINERY Tools and equipment**
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia, Pa.

**HYDRAULIC POWER UNITS OR TOOL HEADS**
Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

**INDEXING AND SPACING EQUIPMENT**
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio

*(Continued on page 318)*

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**INDICATORS, Dial**

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

**INDICATORS, Speed**

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

**INDICATORS, Test**

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Micrometrical Mfg. Co. (Surface roughness & waviness), 321 S. Main St., Ann Arbor, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.



**INDUCTION HEATING EQUIPMENT**

General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio

**INTENSIFIERS, Hydraulic**

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

**JACKS, Machine Leveling**

Enterprise Mch. Parts Corp., Detroit, Mich.

**JACKS, Planer**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

**JIG BORER**

See Boring Machines, Jig

**JIGS AND FIXTURES**

Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

**JOINTS**

See Fittings, Hydraulic, Pneumatic, Etc.

**KEYS, Woodruff, Machine, Special**

Standard Automotive Parts Co., 660-668 Nims St., Muskegon, Mich.

**KEYSEATERS**

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

**KNURL HOLDERS**

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

**KNURLING TOOLS**

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**LAPPING MACHINES**

Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### LAPPING PLATES, Hand
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

### LATHE AND GRINDING DOGS
Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

### LATHE ATTACHMENTS
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Sundstrand Mch. Tool Co., 2431 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

### LATHES, Automatic
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### LATHES, Axle
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### LATHES, Bench
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

### LATHES, Boring
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sidney Machine Tool Co., Sidney, Ohio

### LATHES, Crankshaft
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### LATHES, Double-End
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### LATHES, Duplicating
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

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### LATHES, Engine and Toolroom
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio

### LATHES, Gap
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio
Springfield Mch. Tool Co., Springfield, Ohio
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

### LATHES, Gun
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio

### LATHES, Hollow Spindle
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

### LATHES, Manufacturing Type
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

### LATHES, Spinning
Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio
Ferracute Mcchine Co., Bridgeton, N. J.

### LATHES, Toolroom
See Lathes, Engine and Toolroom

### LATHES, Turret
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

### LATHES, Vertical Turret
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

### LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

### LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.

Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
White & Bagley Co., Worcester, Mass.

**LUBRICATING SYSTEMS**

Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

**MACHINISTS' SMALL TOOLS**

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

**MAGNETIC BASES FOR INDICATORS**

du Mont Corp., Greenfield, Mass.

**MANDRELS**

See Arbors and Mandrels.

**MARKING MACHINES AND DEVICES**

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

**MEASURING MACHINES AND INSTRUMENTS, Precision**

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio
Crane Packing Co., 1800 Cuyler Ave., Chicago
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Max Wyler, 611 W. 43rd St., New York 36, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

**MEASURING WIRES, THREAD, SPLINE AND GEAR**

Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

**METAL, Bearings**

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.,

**METAL FINISHINGS**

Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

**METERS**

See Recording Instruments

**MICROMETERS**

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

**MICROSCOPES, Toolmakers**

Scherr George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

**MILLING ATTACHMENTS**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

**MILLING AND CENTERING MACHINES**

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**MILLING MACHINES, Automatic**

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**MILLING MACHINES, Bench**

Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.

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### MILLING MACHINES, Circular, Continuous
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### MILLING MACHINES, Duplex
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### MILLING MACHINES, Hand
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

### MILLING MACHINES, Horizontal, Plain and Universal
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

### MILLING MACHINES, Lincoln Type
Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### MILLING MACHINES, Planer Type
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co. 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

### MILLING MACHINES, Profile
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### MILLING MACHINES, Ram Type Universal
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

### MILLING MACHINES, Turret Type
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

### MILLING MACHINES, Vertical
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Burke Machine Tool Div., Cincinnati 27, Ohio.

### MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools

### MOLD AND DIE COPYING MACHINES
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

### MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

### MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

### MOTORS, Hydraulic
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### MULTIPLE-SLIDE FORMING MACHINES
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### NIBBLING MACHINES
International Nickel Co., Inc., 67 Wall St., New York, N. Y.
Wales-Strippet Corp., North Tonawanda, N. Y.

### NIPPLE THREADING MACHINERY
Landis Machine Co., Inc., Waynesboro, Pa.

### NUT MAKING MACHINERY
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

### NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

### NUT TAPPERS
See Bolt and Nut Machinery.

### NUTS, Cold Forged, Wing and Cap
Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

### NUTS, Self-locking
Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

### NUTS, Thumb or Wing and Cap
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

### OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

### OIL GROOVERS
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

### OIL SEALS
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

### OILERS AND LUBRICATORS
Madison-Kipp Corp., Madison, Wis.

### OILS, Cutting
See Cutting and Grinding Fluids.

### OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Socony Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

### OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

### OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

### OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

### ORDNANCE MACHINES, Spelial

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

### PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.

### PAINTING EQUIPMENT, Spray

Lowe Bros. Co., Dayton, Ohio.

### PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

### PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

### PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

### PIPE, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

### PIPE, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

### PIPE THREADING AND CUTTING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.

### PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

### PLANERS

Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

### PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., Woodburn Ave., and Penn R. R. Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

### PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

### PLATES, Angle

Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.

### PLATES, Surface

Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave., Cleveland, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Onsrud Machine Works Inc., 3940 Palmer St., Chicago, Ill.

### POLISHING LATHES AND MACHINES

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

### POLISHING TOOLS, Portable

Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

### POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

### PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
duMont Corp., Greenfield, Mass.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Lempco Products, Inc., 5490 Durham Rd., Bedford, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Threadwell Tap & Die Co., Greenfield, Mass.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.

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**PRESSES, Broaching**

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.

**PRESSES, Extrusion**

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

**PRESSES, Foot**

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

**PRESSES, Forging**

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

**PRESSES, Hydraulic**

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel So., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Cch. Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Mch. & Welder Co., Warren, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Lempco Products, Inc., 5490 Durham Rd., Bedford, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

**PRESSES, Screw**

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

**PRESSES, Sheet Metal Working**

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co. (Hydroform), Cincinnati 9, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc., 6499 W. 65th St., Chicago, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Corp., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 50, Ill.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Machine Works, Front St., and Girard Aves., Philadelphia, Pa.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.

**PRESSES, Straightening**

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lempco Products, Inc., 5490 Durham Rd., Bedford, Ohio.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & Kenwood Ave., Chicago, Ill.

**PROFILE—TRACING ATTACHMENTS**

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. (Lathe).

**PROFILING MACHINES**

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George Machine Co., 1110 W. 13th St., Racine, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**PULLEYS**

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

**PULLEYS, Friction Clutch**

Brown & Sharpe Mfg. Co., Providence, R. I.

**PUMPS, Coolant, Lubricant and Oil**

Brown & Sharpe Mfg. Co., Providence, R. I.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

**PUMPS, Hydraulic**

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

**PUMPS, Pneumatic**

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

**PUMPS, Rotary**

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump Div., Detroit Harvester Co., 14300 Tireman Ave., Detroit 28, Mich.
Sier-Bath Gear & Pump Co., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

**PUNCHES AND DIES**

See Dies, Sheet Metal, Etc.

**PUNCHES, Centering**

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

**PUNCHING MACHINERY**

Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Engineering & Research Corp., Riverdale, Md.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wales-Strippet Corp., North Tonawanda, N. Y.
Wiedermann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

**RACKS, Gear Cut**

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

**REAMER HOLDERS**

Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

**REAMERS**

The Atrax Co. (Carbide), 240 Day St., Newington 11, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Cabide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Jarvis Corp., Middletown, Conn.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mohawk Tools, Inc., 910 E. Main St., Montpelier, Ohio.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

**REAMERS, Adjustable**

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**REAMERS, Taper Pin**

The Atrax Co. (Carbide), 240 Day St., Newington 11, Conn.
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

**REAMING MACHINES**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Greaves Machine Tool Co., 2009 Eastern Avenue, Cincinnati, Ohio
Kaufman Manufacturing Co., Manitowoc, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

**RECORDING INSTRUMENTS**

National Acme Co. (for counting), 170 E. 131st St., Cleveland, Ohio.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

**REELS, Stock, Standard and Automatic**

U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

**REFRACTORS, Heat-Treating Furnace**

Norton Co., 1 New Bond St., Worcester 6, Mass.

**REGULATORS, Temperature**

General Electric Co., Schenectady, N. Y.

**REMOVERS, Japan, Enamel, Etc.**

Oakite Products, Inc., 19 Rector St., New York, N. Y.

**RETAINING RINGS FOR BEARINGS, Etc.**

Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

**RHEOSTATS**

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

**RIVET SETS**

Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

**RIVETERS, Hydraulic**

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

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### RIVETERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wood & Co., R. D. Public Ledger Bldg., Philadelphia, Pa.

### RIVETING MACHINES

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

### RIVET MAKING MACHINES

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

### RUBBER PRODUCTS

Garlock Packing Co., Palmyra, N. Y.

### RULES, Steel

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

### RUST PREVENTIVES

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

### SAND BLAST EQUIPMENT

See Blast Cleaning Equipment

### SANDERS

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersol-Rand Co., Phillipsburg, N. J.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

### SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.

### SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

### SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Wallace Tube Co., (Abrasive) 1304-08 Diversey PKwy., Chicago 14, Ill.

### SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

### SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

### SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.

### SAWS, Circular Metal Cutting

Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

### SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

### SAWS, Portable Electric

Millers Falls Co., Greenfield, Mass.

### SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

### SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

### SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

### SCREW DRIVING AND NUT SETTING EQUIPMENT

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

### SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.

Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnson Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P.O. Box 350,
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

### SCREW MACHINE WORK

Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, M. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.

### SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

### SCREW MACHINES, Hand

See also Lathes, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

### SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

### SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Chicago Screw Co., Bellwood, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.

### SCREWS, Self-tapping, Drive

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.

### SCREWS, Thumb

Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### SEALS AND RETAINERS, Oil or Grease

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

### SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.

### SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.

### SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

### SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

### SHAFTS

Jarvis Corp., Middletown, Conn.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

### SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

### SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

### SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Young Mch. Tool Div., Church Rd., Bridgeport, Pa.

### SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Barber-Colman Co. (Hendey Mch. Div.) Rockford, Ill.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Smith & Mills Shapers, Inc., Div. Hamilton-Thomas Corp., Hamilton, O.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

### SHAPERS, Vertical

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

### SHAPES, Structural

Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

### SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.

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Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

## SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.

## SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

## SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hamilton Div. of the Lodge & Shipley Co., Hamilton 1, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

## SHEET METALS

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
New Jersey Zinc Co., 160 Front St., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

## SHEET METAL MACHINES, Shrinking, Stretching, Forming & Flanging.

Engineering & Research Corp., Riverdale, Md.

## SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div. Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

## SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

## SLEEVES

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.

## SLOTTING MACHINES

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Div., United Engrg. & Foundry Co., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

## SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

## SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
La Salle Tool Co., Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Mercury Engrg. Corp., Milwaukee, Wis.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Mch. Corp., Wayne Junction, Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

## SPEED REDUCERS

Boston Gear Work, 320 Main St., North Quincy 71, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

## SPINDLES, Boring and Milling

Pope Mchry. Corp., Haverhill, Mass.

## SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

## SPINNING LATHES

See Chucking Machines.

## SPROCKET CHAINS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

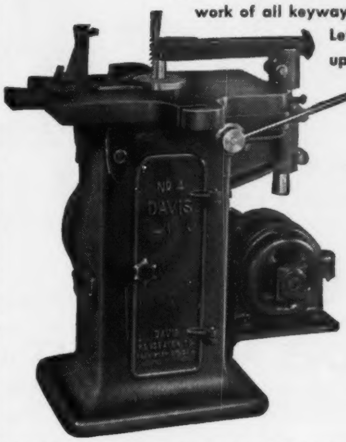
## SPROCKETS

Boston Gear Work, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

*(Continued on page 330)*

# DAVIS KEYSEATERS

**QUICK, LOW COST OPERATION** is made possible by the Davis tilting table, which permits even work tapering as much as 3" per foot to be set up and cut quickly. And Davis multiple tooth cutters make quick work of all keyways up to 1" in width. Let us work out setups to speed up your production.



*Write for Bulletin*

**DAVIS KEYSEATER COMPANY**
405 EXCHANGE ST.
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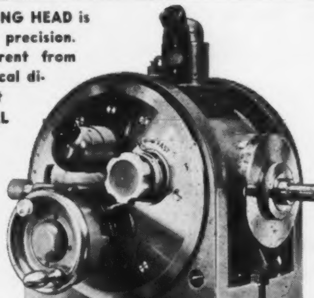
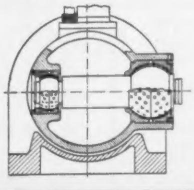
## The New LEITZ Optical Dividing Head

A CUSTOMER SPEAKS:

"Without our Optical Dividing Head, we would not even attempt to make the critical indexing work nowadays necessary for things that fly, or mechanism that must control angular motions to hit targets at a distance, to measure degrees, minutes and seconds, to eliminate angular velocity errors and vibrations in quick running mechanisms, etc "

**The LEITZ OPTICAL DIVIDING HEAD is the last word in indexing precision. Its construction is different from other optical and mechanical dividing heads on the market A NEW DOUBLE SPHERICAL BALL BEARING, DOUBLE READING IN THE SAME EYEPIECE 180° APART, motor drive attachment and other features make the LEITZ an important aid required in any shop where precision is demanded.**

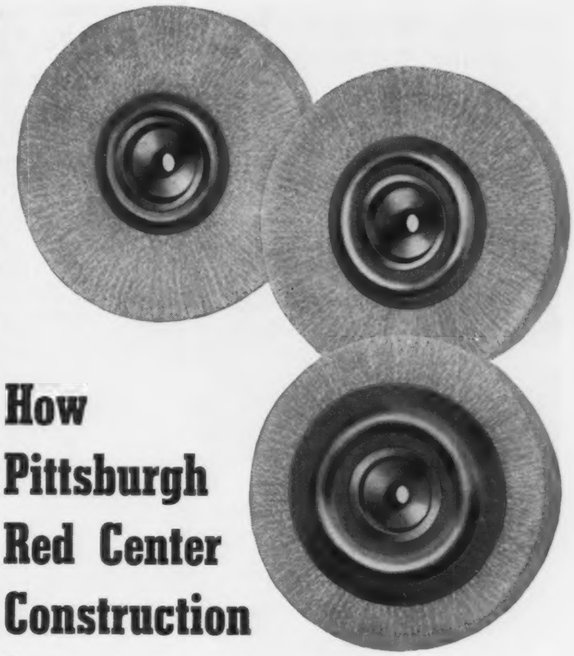




The 2 spherical ends of the spindle are carried in hardened steel cups with several hundred small precision balls held in place by ball cages in such a way that each ball creates its own path. There is no play, either radially or axially, no oil film, no wear and a very large load capacity

**Write for Descriptive Bulletin --- Code GIPAD**

**Geo. SCHERR OPTICAL TOOLS, Inc.**
**200—MA LAFAYETTE STREET • NEW YORK 12, N.Y.**



# How Pittsburgh Red Center Construction Provides

**Faster cutting while maintaining smooth finish • Freedom from shedding • Perfect balance • Longer life**

In conventional brushes, when faster cutting action is desired, coarser wire is used. But increasing the wire gauge causes brittleness, destroying the wearing quality of the brush, and resulting in excessive scoring of the work.

Pittsburgh has solved this problem by maintaining the same ideal gauge wire in every brush, but increasing the fill and diameter of the hub and center plate of brushes designed for faster cutting. Thus, although cutting speed is increased, work remains unscored and the wire does not lose its inherent power to flex. These Red Center brushes last longer, maintain perfect balance throughout life, and do a better job all around.

This is just one example of superior Pittsburgh construction, engineered for both general and specific applications. For details of the complete line, write for free Catalog #54-W. Address: PITTSBURGH PLATE GLASS CO., *Brush Div.*, Dept. W-7, 3221 Frederick Ave., Baltimore 29, Maryland.

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BRUSHES • PAINTS • GLASS • CHEMICALS • PLASTICS • FIBER GLASS

**PITTSBURGH PLATE GLASS COMPANY**

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

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Mullins Mfg. Corp., Salem, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

### STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

### STEEL, Cold Drawn
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div., 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

### STEEL, High Speed Tool
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburgh, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

### STEEL, Machine
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

### STEEL, Stainless
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

### STEEL, Strip and Sheet
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

### STEEL, Tool and Die
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

### STEEL, Zinc, Tin and Copper Coated Strip
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

### STEEL ALLOYS
See Alloys, Steel

### STEEL BARS
See Bars, Steel

### STEEL STOCK GROUND FLAT
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.

### STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

### STOCK STOPS
Wohlnip Products, Inc., 634 Central Ave., East Orange, N. J.

### STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

### STONES, Oil or Sharpening
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

### STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

### STRAIGHTEDGES
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### STRAIGHTENERS, Flat Stock and Wire
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### STRAIGHTENING MACHINERY
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

### STUD SETTERS
Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

### SUB-PRESSES
Waltham Machine Works, Newton St., Waltham, Mass.

*(Continued on page 332)*

For more information on products advertised, use Inquiry Card, page 235

### SUPERFINISHING MACHINES
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

### SURFACE CHECKING EQUIPMENT
Micrometrical Mfg. Co., 321 S. Main St., Ann Arbor, Mich.

### SURFACE PLATES
See Plates, Surface

### SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Lemert Engrg. Co., Inc., 210 E. Jefferson St., Plymouth, Ind.

### SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

### TACHOMETERS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

### TANGS, Replaceable, Drill & Reamer
Nu-Tangs Inc., 1335 Bates St., Cincinnati, Ohio.

### TAPER PINS, Standard
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lempco Products, Inc., 5490 Dunham Rd., Bedford, Ohio.
Pratt & Whitney, West Hartford 1, Conn.

### TAP HOLDERS
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

### TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis Corp., Middletown, Conn.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

### TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

### TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

### TAPS
Besley-Welles Corp., 112 Dearborn Ave., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Middletown, Conn.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.

### TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

### TESTING EQUIPMENT, Tension, Compression, Fatigue, etc.
Olsen Tinius, Testing Mch. Co., Willow Grove, Pa.

### THREAD CUTTING MACHINERY
Brown & harpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Lees-Bradner Co., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

### THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. crew Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### THREAD GAGES
See Gages, Thread.

### THREAD GRINDING MACHINES
See Grinding Machines, Thread

### THREAD MILLING MACHINES
Coulter, James, Machine Co., Bridgeport 5, Conn.
Lees-Bradner Co., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

### THREAD ROLLING HEADS
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

### THREAD ROLLING MACHINES
Landis Machine Co., Waynesboro, Pa.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.

### TIN AND TERNEPLATES
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

### TOOL BITS, High Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., 20 N. Wacker Drive, Chicago 6, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### TOOL BITS, Special Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1200 Woodward Heights Blvd., Ferndale, Mich.

## TOOL GRINDERS
See Grinding Machines for Sharpening, Turning and Planing Tools

## TOOL HOLDERS
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

## TOOLMAKERS' INSTRUMENTS
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

## TOOL RESINS
Marblette Corp., 37-33 Thirtieth St., Long Island City 1, N. Y.

## TOOL STEEL
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

## TOOLS, Carbide-Tipped
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
The Atrax Co., (Carbide) 240 Day St., Newington 11, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Valenite Metals Corp., Box 205, Royal Oak, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

## TOOLS, Lathe, Shaper and Planer
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
du Mont Corp. Greenfield Mass.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Lathrobe, Pa.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.
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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

## TRANSFER MACHINES, Automatic
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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Grant Mfg. & Mch. Co., 90 Sillman St., Bridgeport 5, Conn.

## TUBE FORMING AND WELDING MACHINES
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

## TUBE MILLS
Abbey-Etna Co., 2444 Maplewood Ave., Toledo 10, Ohio.
American Electric Fusion Corp., 2622 Diversey Ave., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

## TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

## TUBING, Flexible
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

## TUBING, Steel
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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.

## TWIST DRILLS
See Drills, Twist

## UNIT HEATERS
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## UNIVERSAL JOINTS
Baush Machine Tool Co., 156 Wassen Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

*(Continued on page 334)*

### VALVE CONTROLS
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadephia, Pa.

### VALVES, Air
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Leigh Dr., Easton, Pa.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

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American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines Ill.
Hunt, C. B., & Son., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydropress, Inc., 350 Fifth Ave., New York 1, N. Y.
Lehigh Foundries, Inc., 1400 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Machine Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Wood, R. D. Co., Public Ledger Bldg., Philadelphia, Pa.

### VIBRATION INSULATION
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Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.
U. S. Burke Machine Tool Div., Brotherton Rd. 17, Cincinnati 27, Ohio.

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### VISES, Planer and Shaper
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Cincinnati Shaper Co., Elan and Garrard Aves., Cincinnati, Ohio.
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South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

### WASHERS, Spring
Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E. Massillon, Ohio.

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Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

### WELDING AND CUTTING GAGES
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### WELDING EQUIPMENT, Electric Arc
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Federal Mch. & Welder Co., Warren, Ohio.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., E. Pittsburgh, Pa.

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Federal Mch. & Welder Co., Warren, Ohio.

### WELDING POSITIONER
duMont Corp., Greenfield, Mass.

### WELDMENTS
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio.
Mahon, R. C., Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

### WIRE FORMING MACHINERY
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

### WIRE NAIL MACHINERY
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

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Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
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Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

### WORM DRIVES
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Philadelphia Gear Works, Erie Ave. and G. St., Philadelphia, Pa.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### WRENCHES, Detachable Socket
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### WRENCHES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

### WRENCHES, Ratchet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### WRENCHES, Tap
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

### WRENCHES, Torque Measuring
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24" Cincinnati Bickford, m.d.
26" Aurora, m.d., taper
32" Aurora, belt drive
36" Cincinnati Bickford, belt drive
No. 2 Colburn Mfg. Type, m.d.
No. 315 Baker Heavy Duty, s.p.d.
No. 417 Baker, m.d., later type
No. 513 Baker, m.d.
#4-48" Defiance Machine Co. Drill, m.d.

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No. 6 Fellows, belt drive
No. 7, 7A Fellows Gear Shapers, belted, m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 61 Fellows, belted, m.d.
No. 61 Fellows, gear box m.d.
No. 61A Fellows, m.d., latest type
No. 648 Fellows, m.d.
No. 645A3 Fellows, m.d.
No. 75 Fellows High Speed, m.d.
No. 75A Fellows, m.d.
No. 712 Fellows, m.d.
No. 4 Fellows Gear Generator, m.d.
No. 715A Fellows High Speed Gear Shaper, m.d.

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No. 36BM Gould & Eberhardt Spur Gear Cutter
Gleason Spiral Bevel Gear Rougher, m.d.
No. 3—36" Brown & Sharpe Gear Cutter
No. 4B Fellows Gear Burnisher
No. 8B Fellows Gear Burnisher
3" Gleason Gear Generator, m.d.
8" Gleason Gear Generator, m.d.
11" Gleason Gear Generator, m.d.
No. 6-60 Brown & Sharpe Gear Cutter, m.d.
Cincinnati Gear Burnisher, m.d.

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9" Pratt & Whitney Hydraulic Spur and Helical
No. 13L8 Fellows Gear Lapper, m.d.
SG11 Gear Grinding Machine, m.d., latest
GG19 Gear Grinding Machine, m.d., latest
GG31 Gear Grinding Machine, Internal Gear & Spline Grinder, m.d.
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18" National Broach Red Ring Gear Lapper, m.d., late

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No. 5AC Lees-Bradner Heavy Type Gear Generator, m.d.
No. 12 Barber-Colman Double Overarm, m.d.
No. 12 Barber-Colman Single Overarm, m.d.
No 34 Brown & Sharpe, m.d., Spur & Spiral
No. 44 Brown & Sharpe, m.d.
#130 Cleveland Rigid Hobber

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18" National Broach & Machine Co.
18" Gleason Bevel Gear Tester, m.d.
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No. 121 Hanchett Production Face Grinder, type BD, m.d.
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14" Pratt & Whitney Vertical, m.d.
No. A-1-8" Arter Surface Grinder
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GRINDERS, CYLINDRICAL, 16" x 72" Norton C, swing 26 , new 1945.
GRINDERS, CYLINDRICAL, 16" x 96" Landis type B, 48" gap, new 1941.
GRINDERS, SURFACE, 14" x 36" Pratt & Whitney vert spdl., 1942.
GRINDERS, SURFACE, 43" No. 16A2 Blanchard rotary, new 1947.
GRINDERS, SURFACE, 72" No. 72 Hanchett rotary, new 1946.
GRINDERS, TOOL & CUTTER, No. 13 Brown & Sharpe universal, new 1942.
LATHES, ENGINE, 14" x 6' bed Hendey toolroom, Timken, 1940.
LATHES, ENGINE, 24" x 20' bed Leblond H.D. G.H., older.
LATHES, TURRET, No. 5 Jones & Lamson universal (2), 1939.
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MILL, No. 3-H Kearney & Trecker plain. horizontal, new 1942.
MILL, Nos. 3K and 4K Kearney & Trecker, rebuilt.
MILL, Nos. 2-4 and 5 Cincinnati Hi power plain.
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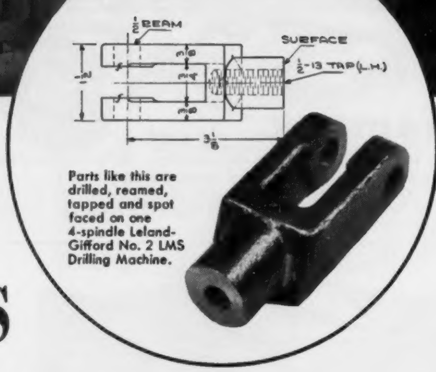


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